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Ontogeny of Motility of the Face[1]

L. KWINT

OF THE total equipment of neuro-psychical potentialities motility is one of the principal components by means of which an individual as a whole reacts to his environment. Motility acquires a special significance in childhood being nearly the only indicator of the rate and character of the general development.

Therefore the motor sphere as a subject of research has recently attracted the attention not only of clinical and psycho-neurological investigators but mostly of workers of various branches of the pedagogical section.

When studying motility the problem of motor ability is of special interest. In accordance with the opinion of most investigators regarding general ability under motor ability we understand a combination of capacities that determine the motor activity of a human organism, its maximum and minimum capacity of readjustment to new situations. We mean here the extent of specialization of motor manifestations and the range within which these manifestations vary respectively according to the different requirements of the environment. "We say that a person has motor ability if he can easily use his motor apparatus for various connected movements, using instruments as a help and perfecting his movements by exercise. A person is defective in his motor ability if he cannot use his limbs, his mechanism of statics, correct innervation, and is limited by a small number of simple motor connections" (4).

Motor ability, its character, volume, and extent is in close connection with the development of the general constitutional capacities of the growing organism evolving under the stimulating influence of its environment. In accordance with this conception when working out the metrical scale, it is correct to select the tests according to the natural evolution of motor capacity. Graded according to age such a scale could serve as a scientific method of investigating innate abilities for certain movements but not habits acquired through individual experience in play or work by special exercises. In this respect, the natural development of mimic motility of the face deserves attention.

Mimics are undoubtedly an emphatic correlator of the evolutionary state of the neuro-psychic sphere. With the development of the latter mimic movements become refined and perfected. This may be seen when comparing the mimics of species of various zoölogical grades; this may also be observed by comparing the mimic movements of a savage and civilized man. Animals have mostly reflex mimic movements directly affected by stimuli of various receptive organs or by internal organic impulses of a general character. More complex mimic movements of a conditioned reflex nature observed in animals are poor and unvarying. The mimic movements of anthropomorphous monkeys become more various and complete than the mimic movements of animals of a preceding evolutionary stage, the mimic movements of savages are more complex than those of monkeys and civilized people have finer and more differentiated mimic movements than savages. We may note also age differences in mimics. Mantegazza (7) writes: "The mimics of a child are extensive but poor in shades, that of a more grown up child is extensive and rich enough in details, a young man's mimics are distinguished by extent and amplitude of contents and especially by effusion, the mimics of an adult are more balanced, more rich in details than in strength of expression, gradually they become less effusive; finally the mimics of an old man are weak, indefinite and very concentric."

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In general, we may state that the development and perfection of mimic movements take place simultaneously with the evolution of the neuro-psychic sphere, beginning with the early stages of childhood, and that with the involutive changes of the personality in senile age the mimic movements are subjected to a reverse development. A number of scientific investigations are devoted to the study of mimics as expressive motility (Piderit (8), Darwin (3), Hughes (5), Bechterew (1), Sikorsky (9), Bell (2), Kirchhoff (6)). The task of this paper is to investigate not expressive mimic belonging to the extrapyramidal motility but voluntary movements of the mimic musculature connected with the activity of the pyramidal, neokinetic system. Therefore, we consider it necessary first of all to determine the conception of voluntary movements. Voluntary movements differ from involuntary ones, as they contain a psychical moment. Genetically voluntary movements are connected with various kinds of involuntary movements as impulses, reflexes, instincts. The latter through interaction of the organism and its environment offer the personality various impressions. Emotions and images are subject to considerable modifications and form the so-called voluntary movements.

In childhood, the process of forming voluntary movements is determined by the so-called circular reaction expressed by automatic frequent repetition of certain casually performed movements connected with Kinesthesia affected by the latter.

"Something is added to an impulse of an involuntary movement transformed into a voluntary one," says Preyer, and something is lost when voluntary movements become involuntary." This something makes the purely psychical moments kinesthetic images, idea of the movements and their aims. In voluntary movements, there is from one part a component of volition activity conditioned by active consciousness as a special manifestation of a highly organized neokinetic (pyramidal) system which serves as an apparatus for acquiring individual experience, and from the other part there is a component involuntary automatic motor mechanism connected with the extra pyramidal (paleokinetic) system dealing with the experience of the species of an organism and determining the formal moments of a movement; rate, skill and other qualities.

Analyzing motility in the aspect of evolution of the cortical and subcortical mechanism and their relations, we may state that the latter are in different functional proportions to each other in their ontogenetic development. With age the cortical mechanism gradually begins to dominate the subcortical.

In the motor activity of a child of preschool age the automatic elements are considerably expressed; the mechanism of voluntary control is not strong enough being in process of development. This is to be seen in the inaccuracy, inconstancy of the voluntary movements, inability for more or less durable motor efforts. The motor activity of a child of school age is characterized by an equal function of both voluntary and automatic mechanisms one balancing the other. The motor activity of a stripling, owing to the period of sex development revealing a new evolutionary stage, is subject to certain dissociations due to the general biological crisis of the age of puberty. The movements at this age become clumsy, angular and often inadequate. The motor mechanism of an adolescent towards the end of sex maturation in connection with the displacement and strengthening of the cortical system becomes associated again; a certain harmony is established with a marked prevalence of cortical-pyramidal principles. The active interaction of the human organism and its environment is accomplished through a number of subsequently connected neuro-psychic phenomena the principal of which are perception, imagery and volition, the environment being the determinant source and point of application of voluntary movements. The latter forming the contents of various acts of behaviour are the general expression of volition which in its turn is directed by imagery originating in the receptive organs. The volitional processes are interactions of kinesthetic images affecting the centres of the motor system and modifying the existing movements long since frequently effected impulsively, reflexively, instinctively. Not only the stimuli of the concrete realities surrounding the person at that moment but the entire individual experience of a man is expressed in voluntary movements which are thus the result of empirical training through involuntary movements effecting kinesthetic images. At the same time voluntary movements express completely new acts of behaviour. Through the mentioned peculiarities voluntary movements become a special expression of the total equipment of a personality. In connection with age, motility develops in a more or less definite succession, but being a function of endogenic inherited tendencies and external conditions of environment it displays accordingly considerable individual fluctuations.

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The evolution of motility takes

place simultaneously with the development of the nervous system. While the development of the cellular elements of the nervous system and the process of myelinization of conduction system are usually completed at the age of 3 the association fibers connecting the nervous cells of various centres of the cerebral cortex continue to develop and differentiate for a long time including the period of sex maturing and according to recent data even the mature age of thirty to forty years.

TABLE 1

Age in years and sex of children tested

	AGE													TOTAL
	4	5	6	7	8	9	10	11	12	13	14	15	16	
Boys	6	10	12	20	18	32	30	20	10	32	16	16	8	230
Girls	8	8	12	8	14	24	38	24	26	22	28	24	10	246
Total	14	18	24	28	32	56	68	44	36	54	44	40	18	476

The existence consequently of certain voluntary movements is determined not only by biomechanical conditions and physiological activity of the muscles but chiefly by the corresponding innervation. The appearance of certain voluntary movements of the growing human organism may indicate the cerebral development of the respective spheres. The conception of voluntary movements given here may be wholly applied to mimic psycho-motility the ontogeny of which is the subject of this paper.

In order to determine the principal tendencies and peculiarities of the development of voluntary mimic movements I have elaborated a special method comprising by means of tests nearly all the possible simple movements of the facial musculature. In choosing the tests I was guided not by the myological architecture of the face, but by the real functional activity of the separate parts of facial musculature; voluntarily performed according to the respective images, as one complete psycho-physiological act. Verbal instructions with an easy description of all required movements are given to the tested person. At the same time the experimenter performs the necessary movement himself and the tested person must control his own performance looking at a mirror.

The tests were given to 476 children of both sexes at the age of four to sixteen years inclusive. They were distributed according to age and sex in the way shown in table 1.

With respect to their physical condition, intellectual abilities and scholarship records, or progress in studies, children of an average development were selected. They were also carefully selected according to age, so that each definite age group was uniform. In each age group were children whose age did not deviate more or less than 4 months from the standard. For instance, children from seven years eight months up to eight years four months belonged to the 8 year standard. Children whose age was more than four months above or below the standard age were not subjected to investigation.

Considering the results obtained we shall mention the data illustrating the age distribution of mimic movements performed synchronously and symmetrically. (See table 2.)

We give here the mean values of the quantity of performal movements for each age group separately. The obtained data reveal a certain regularity in the age distribution of the quantitative volume of voluntary movements of the facial musculature. This volume beginning at the age of four throughout all the subsequent age periods gradually and steadily increases, attaining its highest limit at the age of fourteen. At the ages of fifteen and sixteen years, we observe a slight decline in the number of possible, active mimic movements interrupting somewhat the mentioned progressive tendency of the age evolution of mimic psychomotility.

Regarding the facial movements performed at different times, for the right and left sides separately, we observe a marked tendency to increase the number with the increase of the age level. This is illustrated in table 3.

The low figures here are evident. Of 16 movements of the symmetrical musculature of the face to be performed separately and monolaterally only a very limited number was available which varied in the investigated group of children; judging by the average data from three to seven movements or from eighteen to forty-six per cent. Subjecting the obtained data to a neuro-physiological analysis we may note that the increase of voluntary mimic motility in connection with age takes place simultaneously with ontogenetic development of respective innervation mechanisms, mostly of the sensory motor cortex. As has been mentioned, for the right

TABLE 2

Age distribution of mimic movements

	AGE												
	4	5	6	7	8	9	10	11	12	13	14	15	16
Number of movements	10.5	12.7	13.4	13.8	16.4	17.9	17.9	18.3	18.7	19	20	18.8	19.4
Percentage	40.4	48.8	51.5	53.1	63.1	68.8	68.8	70.4	71.9	73.1	76.9	72.3	74.6

TABLE 3

Increase in number of facial movements with increase in age

	AGE												
	4	5	6	7	8	9	10	11	12	13	14	15	16
Number of movements	2.9	3.7	3.3	4.1	4.8	5.9	6	5.9	5.0	6.6	7.4	6.9	6.9
Percentage	17.9	23.1	20.3	25.4	29.7	36.6	37.5	36.9	37.1	41.2	46.3	42.8	43.1

growth of movement an effective as well as a receptive apparatus must exist. According to the investigations of Jacob Bielschowsky and others in the cerebral cytoarchitecture the main internal layer of the cortex performs the effective functions and the external layer the receptive ones. This is confirmed by the data of the embryogeny showing a development of the internal cortical layer of corpus striatum and the external layer of the primary olfactory organs. The existence of certain voluntary movements shows the functional ability of the centrifugal as well as the centripetal element of the cortex. Being connected with such psychic moments as stimulation to movement, volitional initiative, formation of conceptions of movement and conscious designing of respective motor formulae voluntary movements depend upon the functions not only of the motor centres of the cerebral cortex but upon the frontal gyrus affecting the latter and forming the highest psychomotorium. The process of intercortical myelinization determining the functional capavility begins in the association network of the frontal lobes of the cerebral cortex much later than in other sections. Our data consequently enable us to follow the gradual increase of functional plasticity in the primary and higher stages of the psycho-motor area belonging to the mimic musculature. It is noteworthy that mimic psychomotility as seen from the given tables, continues to increase quantitatively up to the period of sex maturing. At the ages of fifteen and sixteen years, we notice a slight decline in the number of voluntary movements of the mimic musculature. This fact which at first sight appears paradoxical is, however, subjected to regularity of ontogeny of psycho-motility. The progressive development of the latter as well as the whole nervous system, does not cease or decrease during the age of puberty but acquires in connection with the changes due to sex maturation, certain qualitative peculiarities. In the age of puberty there is a certain reconstruction of the motor apparatus as a whole and the ability to master and commensurate movements is interrupted to some extent. Homburger explains this phenomenon by the fact that the central organs lag behind the growth of the motor organs in consequence of which there is a release of the primitive mechanisms. At this period there is an intensive development of the peripheral nerves of the growing organs and the cerebrum in its functions is somewhat retarded not being able to manage the great quantity of afferent stimulation coming along the extended system of peripheral neural connections from the growing organs causing the blood to flow from it to them. The mentioned functional decrease of the cerebral activity at this period depends upon a general decrease of hemoglobins in the blood causing anaemia of the cerebrum.

It seems that these peculiarities of the nervous system at the critical period may explain the decrease in quantity of voluntary movements of the facial muscles of the face observed at the ages of fifteen and sixteen years.

When investigating voluntary mimic movements with respect to their possibility of being performed isolatedly on each side, we note the following peculiarities, besides the mentioned regularity of progressive increase in connection with age characteristic also for synchronous mimic movements. Most of the mentioned movements could not be performed on both sides to the same extent. The isolated movements of the symmetrical muscles or groups of facial muscles successfully performed on one side could not be done on the other side at all, or if performed they were fewer in number and less vigorous.

The same thing was observed in the cases when the face in a calm state did not show any asymmetry, and when the movements of respective mimic muscles were performed synchronously no signs of paralysis or paresis could be revealed. Thus for instance, if the tests such as lifting of the brows, contracting the brows, closing the lids, wrinkling the eyes and lifting of the upper lip were successfully performed synchronously, an isolated asynchronous performance of the mentioned movements could be carried out only on one side. Such a type of performance we call dynamic *anisomimia*. This circumstance deserves special consideration when a clinical investigation of nervous patients is carried on, especially in cases concerning the organic forms of cerebral pathology. An isolated cessation of the functions of the symmetrical muscles serves as a fundamental point in diagnostic inferences of the localization of the process. In the initial stages of the growing illness great importance is attached to innervating asymmetry. It is natural that the mentioned peculiarities of dynamic anisomimia of physiological nature must be taken into consideration in neuroclinical practice in order to prevent diagnostic mistakes. The neurophysiological meaning of this peculiarity is that the functional development of the cerebral cortex is not equal in both hemispheres of the cerebrum. This asymmetry of cortical differentiation though showing a tendency of a certain levelling, in connection with age remains invariable regarding certain facial muscles in the later periods of development with striplings and adolescents and, according to our observations not systematized yet even with adults.

Regarding the movements of facial musculature performed not simultaneously on either side separately we must note that in all our investigations of age groups they are exceedingly limited in number, varying between three and seven out of 16 given movements while the symmetrical and synchronously performed movements vary from nine to twenty out of 26 movements.

The movements of the mimic musculature in most cases not impelled in their development by external stimuli reveal emphatically a natural increase of differentiations resulting from the regularity of the intercortical evolution. The range of possible isolated, monolateral movements of the symmetrical facial musculature may be increased undoubtedly by special exercises as it is done with other muscular groups, particularly the organs of labor activity and movement. But artificially developed movements resulting from an active interaction growth of movement an effective as well as a receptive apparatus must exist. According to the investigations of Jacob Bielschowsky and others in the cerebral cytoarchitecture the main internal layer of the cortex performs the effective functions and the external layer the receptive ones. This is confirmed by the data of the embryogeny showing a development of the internal cortical layer of corpus striatum and the external layer of the primary olfactory organs. The existence of certain voluntary movements shows the functional ability of the centrifugal as well as the centripetal element of the cortex. Being connected with such psychic moments as stimulation to movement, volitional initiative, formation of conceptions of movement and conscious designing of respective motor formulae voluntary movements depend upon the functions not only of the motor centres of the cerebral cortex but upon the frontal gyrus affecting the latter and forming the highest psychomotorium. The process of intercortical myelinization determining the functional capavility begins in the association network of the frontal lobes of the cerebral cortex much later than in other sections. Our data consequently enable us to follow the gradual increase of functional plasticity in the primary and higher stages of the psycho-motor area belonging to the mimic musculature. It is noteworthy that mimic psychomotility as seen from the given tables, continues to increase quantitatively up to the period of sex maturing. At the ages of fifteen and sixteen years, we notice a slight decline in the number of voluntary movements of the mimic musculature. This fact which at first sight appears paradoxical is, however, subjected to regularity of ontogeny of psycho-motility. The progressive development of the latter as well as the whole nervous system, does not cease or decrease during the age of puberty but acquires in connection with the changes due to sex maturation, certain qualitative peculiarities. In the age of puberty there is a certain reconstruction of the motor apparatus as a whole and the ability to master and commensurate movements is interrupted to some extent. Homburger explains this phenomenon by the fact that the central organs lag behind the growth of the motor organs in consequence of which there is a release of the primitive mechanisms. At this period there is an intensive development of the peripheral nerves of the growing organs and the cerebrum in its functions is somewhat retarded not being able to manage the great quantity of afferent stimulation coming along the extended system of peripheral neural connections from the growing organs causing the blood to flow from it to them. The mentioned functional decrease of the cerebral activity at this period depends upon a general decrease of hemoglobins in the blood causing anaemia of the cerebrum.

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After stating the general tendencies concerning the quantity of voluntary movements of mimic musculature in connection with age, we shall consider separate movements in their evolutionary aspects.

If we consider sixty to seventy per cent of positive performance as the index of age conformity with certain movements, we shall be able to give the following ontogenetic characteristics of the investigated mimic movements. By symmetrical and synchronic movements the following data are obtained.

The following movements are performed in quantity not less than two-thirds of cases for each age group.

Beginning with the age of 4: lifting of the brows; slight closing of the lids; screwing up of the eye; tight closing of the lids; closing of the lips; setting the lips as if playing a brass instrument; protruding the lips forward as if pronouncing the letter "o"; blowing out the cheeks; exposing the teeth.

Beginning with the age of 5: drawing down the lower lip.

From 6 years: protruding the lips as if whistling; lifting the corners of the mouth upwards and outwards.

From 7 years: contracting the brows; turning out the lower lip; lifting the chin upwards.

From 8 years: pursing the corners of the mouth towards the midline.

From 9 years: lifting the upper lip; drawing the corners of the mouth, downwards and backwards.

From 16 years: forming a transversal pucker on the bridge of the nose.

Some movements were performed by a small number of children, so that we may consider them not characteristic, i.e., casual for children of normal development. These movements were: drawing back the skin of the head; contracting the nostrils; expanding the nostrils; drawing the ears forward; drawing the ears up; drawing the ears back.

As for the separate movements of mimic musculature which are to be performed asynchronously, i.e., alternately on each side separately, the respective results are given in the following brief record.

Active asynchronic movements: screwing up one eye and tight closing of one eye-lid are performed from the age of four years; slight closing of one eye-lid from 5 years; alternate blowing out of one cheek from 7 years; sideward contracting of the face from 8 years; lifting the corner of the mouth upward and outward from 9 years; exposing the teeth from one side from 10 years. The movements performed by a very small per cent of children included: lifting one brow upwards; drawing one corner of the mouth towards the midline; lifting the outer part of upper lip; and drawing one corner of the mouth downward and backward. The movements not mastered by children with very few exceptions are: contracting one brow; drawing one corner of the mouth downward; and drawing one ear back. The movements never performed by any children with no exceptions are: drawing one ear forward; and lifting one ear upward.

The data of the ontogenetic analysis of facial motility enable us to represent the equipment of active mimic movements by separate investigated age groups in a graded scale. For this purpose only those movements were included in each age series that were performed by 75 per cent of children of respective ages.

For four to five years, 4th grade

1. Lifting of the brows
2. Slight closing of the lids
3. Screwing up the eye
4. Tight closing of the lids
5. Closing of the lips
6. Setting the lips as if playing a brass instrument
7. Protruding the lips forward as if pronouncing the letter "o"
8. Blowing out of the cheeks
9. Exposing the teeth

For six years, 5th grade

10. Protruding the lips forward as if whistling

For seven years, 6th grade

11. Contracting the brows
12. Screwing up one eye
13. Tight closing of the lids of one eye
14. Slight closing of the lids of one eye

For eight years, 7th grade

15. Turning out the lower lip
16. Drawing down the lower lip
17. Lifting the corners of the mouth upward and outward
18. Drawing the corners of the mouth towards the midline

For nine years, 8th grade

19. Lifting the chin upwards
20. Blowing out one cheek

For ten to twelve years, 9th grade

21. Drawing the corners of the mouth downwards and backward
22. Contracting the face sideward

For thirteen to fifteen years, 10th grade

23. Lifting one corner of the mouth upwards and outwards
24. Exposing the teeth from one side

For sixteen years, 11th grade

25. Lifting the upper lip
26. Forming a transversal pucker on the bridge of the nose

The above items of the voluntary mimic movements and their age distribution are not only emphatic illustrations of the before mentioned considerations about the progressive tendencies of facial motility and correlation of motility with neuro-psychical development but they may also have practical application. They may serve as a standard of orientation in clinical practice, in the topical diagnosis of organic neuro-pathological variations in the initial stages of plasticity in cases of constitutional neuro-psychic degeneration, and especially in pedagogical practice when establishing a level of general psycho-motility development.

In order to verify the given graded scale of mimic psycho-motility we consider it of interest to mention here some observations of mentally deficient children in various extent who were tested by the method described in this paper, besides being subjected to psycho-neurological, somatological and sociological investigations. The application of this method as well as the analysis and interpretation of the results obtained, may be seen on concrete examples.

As illustrations we chose material of the oligophrenical type which are mostly deficient in their mental development as well as general motility.

L., a boy of 11 years, 5 months, dull average physical health, displastic constitution with a displastic type of face, left handed, tongue-tied, dull carriage, inexpressive mimics, imbecile.

The scheduled results of investigating the active mimic movements are the following:

SERIES	MOVEMENTS PERFORMED	PER CENT OF TEST
years		
4–5	7	0.78
6	1	1
7	0	0
8	0	0
9	0	0
10–12	0	0
13–15	0	0
16	0	0
Total performance........	8	

The formula for mimic psychomotility is

$$4 - 0.22 + 1 = 4.78$$

Considering the age of the tested equal to 11 years, 5 months, we could expect the performance of tests of 9th Grade for eleven to twelve years. From the results obtained, we may state a retardation in this case according to the formula:

$$9 - 4.78 = 4.22$$

Expressing it in the language of the metric scale, we state a mimic psychomotility development corresponding to the 4.78 grade, consequently, a retardation in respect of ability for creating voluntary movements of the facial musculature in 4.22 grade.

Z. B., a schoolboy of the first group, 9 years old. Unsatisfactory scholarship records, dull, easily excited, physical health unsatisfactory, asthenic constitution, displastic features. Type of face cerebral-respiratory, dull carriage, inexpressive mimic capacity, stuttering in his speech, intellectual development by Binet and Simon equal to 7.8 year standard. Debilitas mentis. Test of mimic psychomotility gave the following results.

SERIES	MOVEMENTS PERFORMED	PER CENT OF TEST
years		
4–5	6	0.67
6	1	1
7	0	0
8	0	0
9	1	0.5
Total performance........	8	

Formula of mimic psycho-motility:

$$4 - 0.33 + 1 + 0 + 0 + 0.5 = 5.17$$

Retardation:

$$8 - 5.17 = 2.83$$

L. B., a schoolboy of second group, 10 years old. Scholarship records—unsatisfactory, exceedingly lively and easily excited. Average health. Asthenic displastic constitution. Carriage, mimics and speech without any peculiarities. Intellectually, sub-normal.

In respect of active mimic movements we get the following results.

SERIES	MOVEMENTS PERFORMED	PER CENT OF TEST
years		
4–5	0	1.00
6	1	1.00
7	2	0.50
8	2	0.50
9	1	0.50
10–12	0	0.00
13–15	0	0.00
16	2	1.00
Total performance........	17	

The formula of development of mimic psycho-motility:

$$4 + 1 + 0.5 + 0.5 + 0.5 + 0 + 0 + 1 = 7.5$$

Retardation is expressed in the formula:

$$9 - 7.5 = 1.5$$

The above observations show, that mentally deficient children of various extent are more or less retarded in respect of mimic psycho-motility according to the data obtained by our method.

To complete the illustration we shall mention here a case when observing children of superior ability.

A boy of 6 years, 4 months, thin, pale. Asthenic constitution with a harmonic type of face, easily excited. Moderately active. He can read, write, count and draw. According to Binet he performs the tests 8, 9, and 10 years. Straight carriage. Expressive speech. *Expressive lively mimics.* Intellectually, supernormal. Testing the mimic psycho-motility gave the following results.

SERIES	MOVEMENTS PERFORMED	PER CENT OF TESTS
years		
4–5	9	1.00
6	1	1.00
7	2	0.50
8	2	0.50
9	2	1.00
10–12	2	1.00
13–15	0	0.00
16	2	1.00
Total performance........	20	

The mimic psycho-motility formula:

$$4 + 1 + 0.5 + 0.5 + 1 + 1 + 0 + 1 = 9$$

The advance in mimic psycho-motility is expressed in the formula.

$$5 - 9 = -4$$

Thus the tested child surpassed his standard by 4 grades.

Thus the data of mimic psycho-motility investigation are confirmed by observations of children not only of normal psycho-physical development selected for the ontogenetic analysis of mimic movements and the drawing of the standard metrical scale of active movements, but of subnormal-oligophrenical and supernormal types with a higher psycho-ability who clearly show a tendency of correlation between the general neuro-psychical development and the state of mimic psycho-motility.

As a result of our investigation we may make the following statements:

1. The number of active movements of facial musculature, i.e., mimic *psycho-motility, infallibly increases* with age.

2. The period of puberty is characterized by a slight decrease in number of the voluntary mimic movements, corresponding with somatoneurological dissociation peculiar to that period.

3. Most of the separate movements of the mimic musculature show a clear tendency to maturation at definite age periods; some movements mature earlier, others later. Some mimic movements do not display any noticeable evolutional regularity.

4. The association systems of the cerebral cortex which continue to develop throughout childhood, puberty and adolescence, are the anatomical-physiological basis of mimic psycho-motility evolution.

5. The ontogenetic analysis of the evolutional peculiarities of active mimic movements permit us to construct a graded, according to age, scale of mimic psycho-motor tests serviceable for investigations of motor ability in pedagogical and neuro-clinical practice.

6. There is a definite positive correlation between the general psychic development and the voluntary mimic motility. The mimic psycho-motility of children of oligophrenical type is very poor and shows a retardation, according to our method, by several age groups. With children of normal development the number of active movements of the facial musculature corresponds with the age standard and the motility of superior children is rich and extensive and exceeds in number of movements the respective age standard.

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An Early Intelligence Test

FLORENCE L. GOODENOUGH

WRITERS on the history of mental testing have usually accredited Binet, in his 1908 scale, with the first attempt to develop an objective series of age-standards by means of which the mental development of individual children might be judged.

Galton's sensory tests described in *An inquiry into human faculty* (1883) were designed primarily for use with adults, as were also the early mental tests developed between 1889–1893 by Cattell, Münsterberg, Jastrow, and others. Age was accordingly not taken into account. Gilbert's tests of school children, the results of which were published in two articles (1894, 1897) were taken over directly from the methods described by Cattell. Although results for the ages six to nineteen years are presented for each test separately, there is no attempt to combine the data into separate age-groups.

Binet's scale covered the ages from three to thirteen years, and was intended chiefly for use with school children. Not until much later, with Kuhlmann's 1922 revision of the Binet tests were the age standards extended downward to cover the first three years of life.

A small number of tests for the earlier mental levels are given in Binet's 1905 scale, but these were not well standardized and are not classified into age-groups. They were designed for use in the testing of older idiots rather than for use with infants.

It is not generally known that as early as 1887 a series of developmental standards constituting a rough age-scale for judging the mental development of infants during the first three years was worked out by Dr. Stanford E. Chaille, Professor of Physiology, Pathological Anatomy and Hygiene at Tulane University. Chaille's report (1) was published in a medical journal of limited circulation; a fact that probably explains why it has escaped the attention of psychologists up to the present time. Although Chaille does not specifically use either the term "mental age" or "mental test," both these ideas are implicit in his discussion and in the organization and presentation of his data.

The first use of the term "mental test" is usually accredited to Cattell in an article published in the *Psychological Review* in 1890. The term "mental age" did not come into use until the publication of Binet's 1908 scale; more than two decades after Chaille's article was published.

In the outset of his article Chaille points out the importance of correct estimation of the course that mental development is taking in the individual child, and the difficulty of making such judgments in the absence of valid comparative data.

> "Many . . . ,misled by love and vanity, attribute superior merit to their own offspring; some few, timid and inexperienced, are distressed by idle fears of deficiencies; so that, on the whole, few parents estimate aright the progress which the ordinary, average baby, especially if it is their first one, ought to make. Doctors and nurses have better knowledge, but even doctors, if as ignorant as myself, must have often deplored their inability to answer with sufficient accuracy the very natural questions, frequently propounded by parents, concerning the age at which this, that, and the other indication of progress should be developed. For this reason it is worth while to note, more fully than is recorded in any book which I have found, the progress which should be expected of the average baby . . . . Teachers greatly need more accurate knowledge of the mental and moral faculties of the average child at different ages. To what extent are these various faculties developed, what peculiarities and what deficiencies characterize different ages?"

Chaille points out the need for a sound understanding of the facts of mental development as a basis for education and training, both for the parent and for the teacher. The practical significance of the abilities and inabilities noted at each age are stressed throughout the article.

He then proceeds in systematic fashion to outline a series of developmental standards for each month of age during the first year, thereafter for the ages 15, 18, 24, and 36 months. The idea of decreasing increments of development with advancing age, a point greatly stressed by Gesell some 38 years later (3 and 4), is evident from his choice of intervals as well as from incidental comments scattered throughout the article.

The data for these standards appear to have been collated from the literature and supplemented by his own observations as a physician. It is noteworthy that many of the individual items correspond fairly closely to those found in the developmental schedules or mental tests for infants published during the past few years. Since the complete series is to be found in the article cited I shall not attempt to reproduce it here, but will merely quote a few representative items for each age.

> "*First four weeks*. From birth, the reflex acts, sucking, crying, hiccoughing, yawning, stretching, etc., are all well done: . . . . During the first fortnight, susceptibility to sounds is usually observed, sudden sounds causing them to start and to blink. They take months to learn to appreciate the *direction* and the *distance* of sound."
>
> "During even the first week, babies probably distinguish light from darkness but not until the second week will their eyes follow a candle. In fact nothing except a candle or a light will cause them to fix their eyes from usually about the tenth to the forty-fifty day."
>
> "Babies usually smile after three weeks of age."

Kuhlmann (6) includes the response by starting or blinking to sudden sounds in his series of three-months' tests (his earliest level), Gesell places this reaction at one week. Linfert and Hierholzer (7) found that the socially stimulated smile occurred in 60 per cent of their cases by the age of one month. Mary Cover Jones (5), however, reports the median age as 58 days: Gesell (3 and 4) places it at three months. The wide variation in reporting these items is in the main due to differences in definition and to manner of eliciting the response. It is evident that Chaille differs no more from the standards laid down by modern investigators than these investigators differ from each other.

> "*One month (30–60 days).* Before the fortieth day, the hands are moved awkardly but voluntarily to the mouth, but other movements of limbs and body continue to be vague, jerky, purposeless. . . . . At thirty to forty days, luminous objects give manifest pleasure."

Kuhlmann includes the carrying of objects to the mouth in his series of three-months' tests. Gesell gives the hand-to-mouth reaction a C rating (i.e., passed by 85–100 per cent of all cases) at four months.

> "*Two months.* Babies begin to acquire some idea of distance so that they less frequently scratch their faces without intending it. . . . . At two and one-half months old, a bottle of water, instead of milk, may be refused with an expression of disgust."

Gesell notes "recognition responses" to mother or bottle at one to two months. Linfert and Hierholzer report facial expression of distaste to salt (more than mere crying) in 50 per cent of their cases at four months.

> "*Three months.* The head can usually be held erect when a baby is three to three and a half months old. . . . . Tears are usually shed the third or fourth month. . . . . The hands are voluntarily lifted to the face much oftener; they are stretched out also to near objects, and the arms are held out to the mother. . . . . When three and a half months old, a baby may be amused by the play of covering and uncovering his face."

Gesell also gives three months as the age for holding the head erect and steady. Linfert and Hierholzer found 46 per cent of their four months old cases were able to do so. Gesell reports tears at one week. Elsewhere in his article, Chaille comments on the great variability in the age at which tears first appear.

> "I have trustworthy evidence of one baby who shed its first tear before it was fourteen days old, and I have now under observation a baby who shed its first tear, a solitary one and out of one eye only, on the ninety-eighth day; yet this infant has never lacked the usual baby accomplishment of crying often and vociferously."

Gesell likewise includes a number of reaching tests in his series. Closing in on a dangling ring is assigned to the four-months' level. Fenton (2) describes the game of "peek-a-boo" mentioned above as having been a great favorite of her child during the sixth month.

> "*Four months.* A baby can sit upright and can execute a few special actions with his hands although he may still often fail to seize objects brought close to him. The use of hands and arms is developed much sooner than is the use of the feet and legs. . . . . They look intently at their own hands or other objects near to them. . . . . At four and a half months a baby may smile at an image in a mirror."

Sitting alone is not usually reported before the sixth month, but sitting with slight support occurs earlier. Gesell includes the inspection of his own hand in play in his four months series, but he places the reaction to a mirror image at seven months. Chaille's comment on the precocious development of the use of the arms and hands is of special interest in the light of recent emphasis upon the law of anterior-posterior development.

"*Five months.* A baby may attempt to move in time with music when five months old, and he may associate his own name with himself and his eyes may seek his nurse if her name be called. Further evidence of the dawn of ideas and associated ideas may be manifested by a baby's anger if not taken out of doors as soon as its cloak and hat have been put on."

"*Six months.* At this age a baby sits up; arms, hands and fingers can accomplish many delicate movements and playthings are enjoyed. . . . Babies respond with jumps and other evidences of gratification to attempts to amuse them; they will stroke the mother's face and babble inarticulate sounds of admiration. . . . . In first efforts at speaking there is always a marked preference for *a* and other vowels."

"*Seven months.* Usually at the seventh and eighth month they begin to crawl on the floor. . . . . A baby may be able to shake its head when told to do so. . . . . By the seventh month babies usually begin to mumble m, m, m, and p, p, p, which soon become mama and papa."

Most of the recent investigators place these abilities at a later age.

"*Eight months.* At this age the infant usually begins to imitate sounds, and may articulate several syllables. Speech is at first always of monosyllables and these reduplicated, dyssyllables come slowly, at about the twentieth month, and polysyllables still more slowly."

Gesell puts the beginning of imitation of sounds at the tenth month.

"*Nine months.* By the ninth or tenth month babies usually begin to rise on their feet by clinging to some object, and to learn to walk. They associate their own names with their image in a mirror and begin to look behind to discover the cause of a shadow."

Gesell puts the ability to pull to a standing position at ten months, Shirley's (8) median age was 47 weeks.

"*Ten months.* At this age a child may be taught to understand that it is naughty to cry in order to get what is wanted. . . . . Usually only two or three words can be spoken."

"*Eleven months.* Many actions may be imitated, and the child may have been taught to be afraid of fire. . . . Gestures, intonations of voice, numerous words and even a few short phrases may be understood, although only a few syllables can be spoken."

Gesell notes that at twelve months, the child will adjust to simple verbal commissions, and will inhibit simple acts on command.

"*Twelve months.* Although infants still prefer, at this age, the rôle of quadruped, yet most of them can toddle a few steps by themselves, and before the second year can not only stand but begin to run alone. . . . . When one year old, infants may imitate the voices of dogs, cats, pigs, donkeys, etc., and may have advanced sufficiently as linguists to put two words together."

"*Fifteen months.* Great progress has been made in motor activity; the hand has become trained to touch with considerable discrimination; a spoon or a glass can be carried to the mouth. . . . . The frowns, irritable ways and angry voice of a parent may be imitated by a child when only fifteen months old, and be transmitted thus early from father to son."

Gesell also puts the use of a spoon at fifteen months.

Eighteen months to two years old. "At this age the difference between *one, two,* and *several* is appreciated; at two and a half years old a child may count to twelve, but ordinarily even at three years of age, they cannot count and appreciate more than *four* or *five* and it takes them from the sixth to the seventh year to get up to one hundred."

Counting two blocks is graded as a two-and-a-half year test in the

Merrill-Palmer series (9); counting four pennies is placed at age four by Terman (10), and at age five by Kuhlmann (6).

The standards for two and three years as given by Chaille have to do largely with personal-social qualities and with suggestions for training. Like those reported for the earlier ages they tend to suggest a somewhat higher standard of development, age for age, than is reported by most of the modern investigators. The difference may be due either to more lenient standards or to the fact that most of the reports of infant development published up to that time were based upon children of superior parentage. There is reason to suppose that the children whom Chaille himself had opportunity to observe were likewise from the more intelligent social classes.

The article also includes a number of tables showing age-changes in height, weight and chest circumference, eye color and hair color. Dates for the eruption of the temporary teeth are also given, as well as notes on a number of other items of physical development.

DISCUSSION

The article described here is believed to be the earliest published example of an attempt to compile a series of normative standards based upon the *age at which various abilities develop in the average child* for use in estimating the mental level of individuals. Like many other scientific discoveries that were made somewhat in advance of their time, it attracted so little attention that when, more than twenty years later, the same idea occurred to Binet who incorporated it into his 1908 scale, the previous work of Chaille had been completely forgotten (if, indeed, it had ever been called to the attention of psychologists or others interested in the subject) and Binet was accordingly given entire credit for the concept. Simple and obvious as the device may seem, it was nevertheless destined to revolutionize the entire theory and practice of mental testing. Its importance is well summed up by Terman (10) who comments upon it as follows:

> "Why should a device so simple have waited so long for a discoverer? We do not know. It is of a class with many other unaccountable mysteries in the development of scientific method. Apparently the idea of an age-grade method, as this is called, did not come to Binet himself until he had experimented with intelligence tests for some fifteen years. At least his first provisional scale, published in 1905, was not made up according to the age-grade plan. It consisted merely of 30 tests, arranged roughly in order of difficulty. Although Binet nowhere gives any account of the steps by which this crude and ungraded scale was transformed into the relatively complete age-grade scale of 1908, we can infer that the original and ingenious idea of utilizing age norms was suggested by the data collected with the 1905 scale. However the discovery was made, it ranks, perhaps, from the practical point of view, as the most important in all the history of psychology."

BIOGRAPHICAL NOTE

Dr. Stanford Emerson Chaille, son of William Hamilton Chaille and Mary Eunice Stanford was born at Natchez, Miss., July 9, 1830. He received the A.B. degree from Harvard in 1851, studied medicine at Tulane from 1851-1853, then returned to Harvard where he received the M.A. degree in 1854.

He studied physiology under Claude Bernard in Paris for three years. At the outbreak of the Civil War he returned to America and served as surgeon and medical inspector for the C.S.A. Army of Tennessee from 1862-1865. At the close of the war he became a member of the Faculty of Medicine at Tulane, where he held successfully the rank of demonstrator of anatomy, professor of physiology, pathological anatomy and hygiene, dean of the medical school, professor emeritus until his death in 1911.

Chaille is the author of many scientific articles, the greater number of which were published in the *New Orleans Medical and Surgical Journal* of which for many years he was co-editor. His interest in the functional aspects of child development was probably stimulated in connection with the popular lectures which he was accustomed to deliver to parents and teachers.

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A Study of the Attitudes of Teachers Toward Behavior Problems

WINIFRED E. BAIN

HOW serious is it for a school child to smoke? Is day dreaming more serious than whispering in school? Is it worse for Mary to be profane than for John to explode with an oath? Beliefs concerning the seriousness of misbehavior of children are dependent upon social standards of conduct. The activities of individuals become problematic if they conflict with the ideals held by others for desirable behavior. Such ideals assume significance since standards held for conduct influence measures which are taken for prevention and correction of difficulties.

Much concern has been apparent in the past decade over what may be deemed normal child behavior. Research and clinical experience have tended to shift opinions with regard to the effect of certain childish tendencies upon normal functioning in adult life. It is probable that fuller understanding of the nature and needs of childhood and of trends in social thought have influenced the attitudes held about what is natural behavior and which deviations from social standards are more serious in their consequences.

This study deals with the attitudes of six groups of teachers toward the seriousness of common behavior problems in children as measured by ratings on a scale devised by E. K. Wickman (2) and reported in Children's Behavior and Teachers' Attitudes.[1] The teachers who made the ratings were enrolled in certain classes in Teachers College, Columbia University. Three of the groups made ratings in 1927. Three corresponding classes rated the scale in 1932—five years later. This made possible an analysis of teachers' attitudes toward behavior problems at intervals five years apart in a decade rife with concern about child development and welfare.

PURPOSE AND CHARACTER OF THE FIRST STUDY

The study made in 1927 was carried on for three purposes. The first was to afford an analysis of the character of the attitudes held by various groups in Teachers College pursuing work in different fields; the second purpose was to discover what differences might be held in attitudes toward behavior difficulties when occurring in boys and the same when occurring in girls.

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[1] This study was begun through the courtesy of E. K. Wickman before the publication of Children's Behavior and Teachers Attitudes, and carried on with the coöperation of the Child Development Institute, Teachers College, Columbia University.

Further, it was thought that the effect of teaching in the various courses might be measured if attitudes were recorded at the beginning of a semester of work, and again at the end.

For these purposes three classes were selected to coöperate in the study. Classes I and II were pursuing courses dealing directly with the development and behavior of children. Class III was concerned with the training of teachers, and therefore dealt only in an indirect way with the nature and needs of childhood, as such study is needed in order to determine the nature of practical educational work. Class I was enrolled in a course named "Mental Development of the Preschool Child." About this course the catalog said in part: "This course will undertake to trace mental development from birth to five years of age .... the attempt will be made to relate mental growth to physical development and to the social aspect of child life. Special stress will be put on the consideration of the emotional life of young childhood and of theories of behavior." Class II was made up of people taking a course called "Field Work in Education of Parents." Excerpts from the catalog description follow: "This course includes observation and discussion of activities of groups of parents .... there will be conferences with the instructor and others based upon observation of the work of such groups leading to an appraisal of materials and methods of work with parents and others interested in children." Class III was engaged in studying the problems of a training school for teachers in a Normal or Teachers College. The description of this course includes the following significant statements: "This course is intended for directors of training schools, critic teachers, or supervising teachers in training schools, demonstration, and other laboratory schools. It considers directly the work and problems of inducting intending teachers into their profession." The list of topics following this statement included mention of manifold duties of teachers preparing for such work, but no specific mention of the teachers' study of children.

Purpose and character of the second study

The second study which was undertaken in 1932 was made primarily to ascertain whether the attitudes of corresponding groups working in Teachers College were similar to or different from those held by the students measured five years previously. Each of the six groups was asked to rate on the Wickman scale the degree of seriousness which they attached to various behavior problems of children at the beginning of a semester of study, and again at the end. Comparisons were then made between attitudes held before and after the teaching period; also between attitudes held in 1927 and those held in 1932 as indicated on the scale.

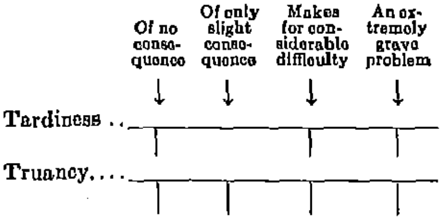
The personnel of the six classes was rather typical of Teachers College groups. They were all graduate students with the exception of a small percentage of people having completed two years of college work and two or more years of successful teaching. Practically all had had some experience in educational work. This experience represented a wide range of types,—from nursery school through college—with a representation of special interests in various fields, such as home economics, psychology, and the like. A small percentage were special workers in such fields as religious education, nursing, parent education, and psychiatric social work.

The curriculum of Teachers College in 1932 was somewhat changed from that in operation in 1927. However, groups were selected for the repetition of the earlier study which were as nearly comparable as possible to those which made the first rating. In the catalog of 1932 Class I was entitled "Mental and Social Development of the Young Child." Its description corresponded closely with that of the corresponding class in 1927: "This course will consider development from mental, social, and emotional aspects; physical and educational development will be presented as factors in mental and social growth." To make up a group comparable to that of Class II in the former study two classes were combined; Class A was called "Child Development and Parent Education." The catalog states the purposes of this course as follows: "(1) to orient the student in the field of child development and of parent education, (2) to study the development of children from the prenatal period through adolescence from a point of view which will integrate the physical, nutritional, mental, social, and emotional aspects, (3) to study the historical and social background of the family of today, and the influence of family life and parent-child relationships on child development, (4) to provide experience with children and their parents in order to integrate theoretical information with actual problems." Class B, an "Advanced Course in Parent Education" was described as follows: "This course is offered for advanced students in Parent Education. The work will be based upon individual projects, and specific programs connected with the field of work. Actual problems in organization, administration, and leadership of Parent Education programs will be used as basic material for class discussion and study." Class III, although covering similar material as that in the course offered as Training School Problems in 1927, was in 1932 organized in two groups: Group A, "Training School Problems," was described in the catalog identically as quoted in relation to this course in the former study. Group B, a course called "Organization and Supervision of Student Teaching," covered a list of topics similar to those considered by Group A, but carried the following description of organization of work: "Students register for their entire time in this course for the equivalent of two semesters. In addition, a period of practice is required. . . . . The work preparing specifically for critic teaching in normal schools and Teachers Colleges will occupy approximately one-half of the students' time. The other half will be divided about equally between: (1) supplementary professional work in subject matter fields in which the critic teacher intends either to teach or to supervise . . . . and (2) general professional and general background work." The combination of these various groups was estimated by those in charge of the courses to constitute comparable classes to the three which had been studied five years previously. Throughout this account, the groups will be designated in each study as Class I—Child Development; Class II—Parent Education; Class III—Training School Problems.

The rating scale

Each person participating in the study was asked to rate fifty behavior problems of children on the Wickman Scale (2). The fifty problems were listed, and at the right of each a scale line was drawn on which ratings were placed indicating the seriousness of the problem in the estimation of the rater, thus:

How serious (or undesirable) is this behavior in *any* child?


Of no consequence
Of only slight consequence
Makes for considerable difficulty
An extremely grave problem
Tardiness . .
Truancy. . . .

Explicit directions accompanied the scale instructing the rater to rate each item, answering the question "How serious is it for the individual child who shows this behavior? In other words, how much does it make him a problem child, disturbing or a misfit? This amounts to the same thing as asking, How undesirable is this behavior in the school child?" The raters were further asked to work as rapidly as possible in an effort to get their first reaction, and to consult no one in answering the questionnaire (2).

The ratings thus recorded were scored by a calibrated rule containing 20 equal divisions, to each of which scores from one to twenty were assigned (2). Means and probable errors were computed for each item on the scale as rated by each of the groups in the two studies. These averages have been used in the analysis which follows.

Comparison of ratings on boys and girls

Note has previously been made of the fact that each class made two ratings on this scale; one at the beginning of a semester of study; the other at the end. In the first study ratings were made separately on the seriousness of the various items of behavior when they occurred in girls, and the same when they occurred in boys. The correlations between the ratings on seriousness of the various acts of behavior in boys and the same when occurring in girls ranged from .91 ±.02 to .95 ±.01. (See table 1.) These correlations and all others used throughout this report were computed by the method of rank differences and converted into corresponding *r* values. Since for the most part it was found that in the opinion of the raters behavior serious for one sex was serious also for another, separate ratings for boys and girls were not made in the second study.

RESULTS OF FIRST STUDY

What were serious problems in children according to the opinion of the teachers making the ratings in 1927? In general, problems relating to sexual immorality and dishonesty were assigned the place of greatest seriousness by all groups. These included untruthfulness, cheating, stealing, masturbation, heterosexual activities, and obscene notes. In contrast those problems relating to difficulties which disturb a teacher in the conduct of school work were rated as least serious by all groups. These included whispering, interrupting, inquisitiveness, restlessness, silliness, thoughtlessness, and inattention. With fair consistency the ratings in the mid-portion of the scale were shared by problems relating to difficulties with authority, such as, disobedience, impertinence, and temper tantrums; problems of social antagonism including resentfulness, sullenness, domineering, and stubbornness; and problems describing withdrawing, recessive personality traits, such as, shyness, sensitiveness, fearfulness, unsocial withdrawing, dreaminess, and physical cowardice. In this middle group there was a tendency to assign relatively less seriousness to the last mentioned tendencies of withdrawal.

TABLE 1

Correlations between ratings on seriousness of behavior in boys and in girls

First study

	FIRST RATING	SECOND RATING
	r	*r*
Class 1—Child Development	.93 ±.02	.95 ±.01
Class 2—Parent Education	.92 ±.02	.93 ±.02
Class 3—Training School Problems	.94 ±.01	.91 ±.02

This general direction of the teachers' weighting of the fifty behavior problems was somewhat different from that maintained by teachers reported by Wickman in the experimental groups which he studied during the same year. In the Wickman study, as in the one here reported, problems of sex, stealing, and dishonesty were considered most serious. Those of withdrawing, recessive personality traits were rated as least serious, while between the two extremes were located problems of application to school work and those of antagonistic, aggressive personality traits, with somewhat less seriousness attached to the last group.

The tendency of the Teachers College groups to view with little concern the age old disturbances of school routine appeared to indicate at the outset the influences of modern educational methods which encourage greater freedom for social communication and expression in the classroom.

After a semester of work in the various courses when ratings were again made, certain consistent trends toward changes of attitude in relation to different types of problems were apparent in Classes I and II pursuing courses in Child Development and Parent Education. Class III, studying Training School Problems, made little change. Table 10 shows correlations between first and second ratings ranging from .86 ±.03 to .89 ±.03 for the first two classes, and .92 ±.02 to .93 ± .02 for the third class. These comparisons appear to indicate that there was less change in the group which made no specific study of children than in the two groups which did. Comparisons were further made of the rank accorded specific problems in the opinion of the teachers at the beginning of their courses and those held at the end. In Classes I and II problems of unsocial, introverted, and recessive types were ranked relatively more serious on second rating by five or more points in order of arrangement in several cases. Such problems as dreaminess, shyness, fearfulness, unsocial withdrawing, sullenness, and unhappiness were shown to have relatively greater import in the minds of the members of the Child Development and Parent Education classes after their period of instruction than they had at the beginning of the semester. The same method of comparing differences in rank order showed in these classes a tendency to assign less seriousness to problems relating to sex, such as heterosexual activity, masturbation, and obscene notes, and to one or two offenses against social tradition, such as, tardiness and smoking. Such changes in attitude were not apparent in the comparison of first and second ratings by the class in Training School Problems, for which close agreement of opinions has already been noted in a high correlation.

Our speculation is that the changes which took place in the order of arrangement resulted from a revision of standards of conduct by those who made the ratings, and that these new standards were derived from a clearer understanding of the tendencies in children which make for good or ill in social life. The increased importance placed upon the behavior of the shy retiring child leads to the inference that these teachers had come to base their evaluations more on the welfare of children and less on their own comfort and traditions. The child who habitually resorts to dreaming of unrealized success and quiet retreat from combat is not usually disturbing in school. He has often been known for this reason to be a favorite with the teacher, and from her in this way he has gained recognition which he has not earned through active achievement. Such tendencies, though inoffensive in a teacher dominated school, make for the development of ineffective and often pathological individuals in society. The changes in rating appeared to show recognition of these facts. On the other hand, it is probable that the raters had come to look more objectively and less emotionally on the problems of sex and other traditional forms of active misconduct. On their first rating many of the teachers were so shocked by the mention of sex difficulties that they extended the scale line across the margin of the paper and placed their ratings at the extreme end or drew arrows to show that their estimate of the seriousness of such misconduct could not be measured on the scale. It appeared, therefore, that the changes in ratings at the end of the semester indicated a tendency to base standards of conduct on objective consideration of the good of the child rather than on convenience, tradition or emotional abhorrence. A conclusion that attitudes were changed by teaching in specific courses could not be accurately supported in view of the set up of the study, but such an inference might be drawn from the fact that a greater tendency toward change appeared in the two classes which had specific instruction with regard to the nature and behavior of children than in the one which considered methods of training teachers without direct attack on the basic study of children.

The changes in attitudes in Classes I and II appear to be in the same general direction of the thinking of Mental Hygienists of the times. In table 2 is reported the correlation between the ratings of the three classes in this study with those made by a group of thirty Mental Hygienists and reported in the Wickman study (2). It will be seen that the class in Child Development raised its correlations with the Mental Hygienists from .18 ±.10 for boys and .24 ±.09 for girls on first rating to .47 ±.07 and .43 ±.08 on second rating. The class in Parent Education correlated .53 ±.07 and .54 ±.08 on first rating, and .71 ±.05 and .68 ±.05 on second rating. Class III maintained a fairly even correlation of .15 ±.10 and .17 ±.10 on first rating, and .21 ±.09 and .20 ±.09 on second rating.

It must be remembered that the changes apparent in attitude of the classes after they had completed courses dealing with the development and behavior of children indicate only a general tendency toward a change in thinking; yet this trend in the direction of greater consideration for the importance of negative types of social reaction was sufficient to inspire a repetition of the measurement of teachers' attitudes five years later.

TABLE 2

Correlations between ratings by mental hygienists (2) and by various classes

First study

	FIRST RATING		SECOND RATING	
	Boys	Girls	Boys	Girls
Class 1—Child Development	.18 ±.10	.24 ±.09	.47 ±.07	.43 ±.08
Class 2—Parent Education	.53 ±.07	.54 ±.08	.71 ±.05	.68 ±.05
Class 3—Training School Problems	.15 ±.10	.17 ±.10	.20 ±.09	.21 ±.09

Second study

	FIRST RATING	SECOND RATING
Class 1—Child Development	.64 ±.06	.66 ±.06
Class 2—Parent Education	.84 ±.03	.79 ±.04
Class 3—Training School Problems	.51 ±.07	.47 ±.08

RESULTS OF SECOND STUDY

What were considered serious problems by the teachers in the second study? The opinions of the raters in 1932 agreed more closely with the attitudes of the Mental Hygienists in the Wickman study at the beginning of the semester than did those of the classes in 1927 at the end of their courses. Table 2 shows the correla-

Diety has been put upon new bases. Traditions have been overhauled. If credence may be placed upon this interpretation, it gives some occasion for caution, lest our newer standards lose sight of social integrity.

One peculiarity of the recent rating of teachers is apparent on consideration of the probable errors of the averages. These were tremendously high. For the most part they fell in the range between 3.5 and 5.0, although some were lower and some few were as high as 9.0. The variability in these ratings was far greater than that obtained in the first study where probable errors clustered around 2.5 and 3.0 with only a few as high as 4.0. Wichman's experimental groups rated with less spread than did the raters in either of the studies made at Teachers College. Some disagreement in opinions might be expected from the fact that the types of conduct listed on the scale were not defined and might conceivably mean one thing to one individual and something different to another. Again chance for variation in opinion might be afforded by the range of children's age levels which users of the scale were asked to consider. Certain types of behavior might be thought to be normal for children of one age and unwholesome for those older or younger. However, the spread of ratings increased to such an extent in the later survey as to present an interesting condition of affairs. The greater scatter of ratings appears to indicate that although the means may be taken to show a general direction of thinking, this trend is not a sweeping one. It may be a condition which accompanies a shift in social values. It is probable also that the students in 1932 were beginning to realize that there is need for a more complete picture than the Wickman scale gives of an individual child's behavior before the seriousness of that conduct can be determined. Although it has been customary to think of behavior problems as separate entities, recent findings have emphasized that the relationship of one type of behavior to another must be considered, rather than any one offense by itself, in determining the seriousness of conduct. Because of the wide scatter in ratings on any given items many of the differences in averages are more apparent than real. Tables 4 to 9 list items which were rated reliably more or less serious by the classes in the second study. These show a complete agreement with the tendency reported in the first study to consider least serious those offenses which interrupt the even tenor of traditional school routine. Among the most serious problems are still to be found heterosexual activity from among the list of sex difficulties which formerly occupied a position of extreme importance; and cheating, stealing and cruelty, or bullying, from among the list of offenses against social integrity. Other items which make up the list of problems of greatest weight for the most part, are those which describe behavior of the fearful, insecure, and unhappy individual.

After a semester of study the classes in 1932 changed their attitude but little. The correlations between first and second ratings made by these groups may be seen in table 10 to be very high, much higher than those

TABLE 4

Problems rated reliably more or less serious by class 1, child development, first rating (second study)

	More Serious Than		More Serious Than
Easily discouraged	Whispering[1]	Untruthfulness[2]	Profanity
Truancy	Interrupting	Temper tantrums	Tardiness
Suggestible	Imaginative lying	Stealing	Disorderliness
Obscene notes	Inquisitiveness	Unhappy, depressed	Slovenliness
Unsocial withdrawing	Restlessness	Heterosexual activity	Smoking
Fearfulness	Thoughtlessness	Cheating	Tattling
Cheating	Silliness	Nervousness	Dreaminess
Nervousness	Profanity		Stubbornness
Cruelty	Tardiness		Overcriticalness
Untruthfulness	Disorderliness		
Temper tantrums			
Stealing			
Unhappy, depressed			
Heterosexual activity			

[1] Rated as least serious of all items.
[2] Rated as most serious of all items.

TABLE 5

Problems rated reliably more or less serious by class 1, child development, second rating (second study)

	More Serious Than		More Serious Than
Easily discouraged	Whispering[1]	Nervousness[2]	Profanity
Lack of interest	Interrupting	Fearfulness	Tardiness
Temper tantrums	Imaginative lying	Unreliableness	Disorderliness
Enuresis	Inquisitiveness	Cheating	Slovenliness
Truancy	Silliness	Cruelty, bullying	Smoking
Obscene notes	Restlessness	Unhappy, depressed	Tattling
Unsocial withdrawing	Thoughtlessness	Stealing	Impudence
Suggestible	Tattling	Heterosexual activity	Inattention
Nervousness	Slovenliness		
Fearfulness			
Unreliableness			
Cheating			
Cruelty, bullying			
Unhappy, depressed			
Stealing			
Heterosexual activity			

[1] Rated as least serious of all items.
[2] Rated as most serious of all items.

TABLE 6

Problems rated reliably more or less serious by class II, parent education, first rating (second study)

More Serious Than		More Serious Than	
Physical cowardice	Whispering[1]	Easily discouraged[2]	Smoking
Domineering	Interrupting	Unreliableness	Thoughtlessness
Sensitiveness	Profanity	Heterosexual activity	Silliness
Enuresis	Imaginative lying	Cruelty, bullying	Slovenliness
Resentfulness	Disorderliness	Nervousness	Impudence
Unsocial withdrawing	Inquisitiveness	Fearfulness	Inattention
Suggestible	Tardiness	Unhappy, depressed	Disobedience
Easily discouraged	Restlessness		
Unreliableness	Smoking		
Heterosexual activity	Thoughtlessness		
Cruelty, bullying			
Nervousness			
Fearfulness			
Unhappy, depressed			

[1] Rated as least serious of all items.

[2] Rated as most serious of all items.

TABLE 7

Problems rated reliably more or less serious by class II, parent education, second rating (second study)

More Serious Than		More Serious Than	
Stealing	Whispering[1]	Easily discouraged[2]	Stubbornness
Cheating	Interrupting	Suggestible	Tardiness
Resentfulness	Imaginative lying	Unsocial withdrawing	Smoking
Unreliableness	Inquisitiveness	Cruelty, bullying	Slovenliness
Easily discouraged	Disorderliness	Unhappy, depressed	Thoughtlessness
Suggestible	Profanity	Heterosexual activity	Impertinence
Unsocial withdrawing	Restlessness	Fearfulness	
Cruelty	Disobedience	Nervousness	
Unhappy, depressed	Tardiness		
Heterosexual activity	Stubbornness		
Fearfulness			
Nervousness			

[1] Rated least serious of all items.

[2] Rated most serious of all items.

TABLE 8

Problems rated reliably more or less serious by class III, training school problems, first rating (second study)

	More Serious Than		More Serious Than
Temper tantrums	Whispering[1]	Nervousness[2]	Slovenliness
Selfishness	Interrupting	Unhappy, depressed	Tardiness
Cruelty, bullying	Imaginative lying	Unreliableness	Disorderliness
Destroying materials	Inquisitiveness	Cheating	Shyness
Nervousness	Restlessness	Masturbation	Dreaminess
Unhappy, depressed	Silliness	Obscene notes	Tattling
Unreliableness		Untruthfulness	Thoughtlessness
Cheating		Stealing	Sensitiveness
Masturbation		Heterosexual activity	Inattention
Obscene notes			
Untruthfulness			
Stealing			
Heterosexual activity			

[1] Rated least serious of all items.
[2] Rated most serious of all items.

TABLE 9

Problems rated reliably more or less serious by class III, training school problems, second rating (second study)

	More Serious Than		More Serious Than
Nervousness	Whispering[1]	Unreliableness[2]	Tardiness
Unhappy, depressed	Imaginative lying	Obscene notes	Thoughtlessness
Cruelty, bullying	Restlessness	Untruthfulness	Disorderliness
Destroying materials	Interrupting	Cheating	Shyness
Masturbation	Inquisitiveness	Heterosexual activity	Stubbornness
Suggestible	Silliness	Stealing	
Unreliableness			
Obscene notes			
Untruthfulness			
Cheating			
Heterosexual activity			
Stealing			

[1] Rated as least serious of all items.
[2] Rated as most serious of all items.

TABLE 10

Correlations between ratings made at beginning and end of college courses by each class

	FIRST STUDY		SECOND STUDY
	For boys	For girls	
	r	*r*	*r*
Class 1—Child Development	.88 ±.03	.89 ±.03	.95 ±.01
Class 2—Parent Education	.86 ±.03	.87 ±.03	.96 ±.01
Class 3—Training School Problems	.92 ±.02	.93 ±.02	.96 ±.01

TABLE 11

Comparison of first and second ratings by class I, second study, on seriousness of problems

MORE SERIOUS ON SECOND RATING	POINTS OF DIFFERENCE IN RANK ORDER	LESS SERIOUS ON SECOND RATING	POINTS OF DIFFERENCE IN RANK ORDER
Dreaminess	5	Impudence	5
Impertinence	8	Shyness	5.5
Sullenness	10	Laziness	5
Unreliableness	17	Untruthfulness	14
Enuresis	6	Temper tantrums	10
		Masturbation	11

TABLE 12

Comparison of first and second ratings by class II, second study, on seriousness of problems

MORE SERIOUS ON SECOND RATING	POINTS OF DIFFERENCE IN RANK ORDER	LESS SERIOUS ON SECOND RATING	POINTS OF DIFFERENCE IN RANK ORDER
Silliness	5	Disobedience	7
Inattention	6.5	Dreaminess	6
Selfishness	5	Stubbornness	7
Truancy	6	Shyness	8
Destroying materials	8	Suspiciousness	6
Obscene notes	8	Sensitiveness	8.5

TABLE 13

Comparison of first and second ratings by class III, second study on seriousness of problems

MORE SERIOUS ON SECOND RATING	POINTS OF DIFFERENCE IN RANK ORDER	LESS SERIOUS ON SECOND RATING	POINTS OF DIFFERENCE IN RANK ORDER
Suggestible	7	Smoking	6
Tattling	7	Physical cowardice	6
Sensitiveness	8	Thoughtlessness	5
Suspiciousness	8	Stubbornness	8
Slovenliness	6	Sullenness	5
Impertinence	15	Impudence	10

recorded for similar comparisons on Classes I and II in the first study. Relatively few of the items on the scale were changed in rank order by five points or more in any class. Those items which showed a difference of this magnitude are listed in tables 11, 12 and 13. It is probable that a different type of instrument is needed in order to measure the changes brought about in thinking by the courses offered in 1932, since from the outset the teachers in all classes showed a different point of view than that indicated by the survey made five years previously.

SUMMARY AND INTERPRETATION

It must be remembered that while many comparisons noted in these studies are statistically reliable, many others are of interest because of the frequency with which they indicate trends shown in ranking certain types of behavior relatively more or less serious than others on repeated measurement of the attitudes held by the same or comparable groups of teachers. Allowing this latitude in analysis there appeared to be a general belief in the equality of conduct acceptance in boys and in girls. Changes in thought at the end of a period of teaching in the first study were in the general direction of greater agreement with Mental Hygienists with whose ratings comparisons were made. This fact forecasts the condition of thinking which appeared five years later in a repetition of the study, when comparable groups of teachers approximated the ratings of the Mental Hygienists more closely than did earlier classes with which they were compared. In view of the purport of these changes it was perhaps not surprising that a wide scatter of opinion existed among the modern teachers whose attitudes were studied.

Fluctuation in the beliefs of teachers is apparent to anyone who has the eye to see the differences between the "new" schools and the "old," since what is thought to be important or unimportant influences what is done. Shifts in methods of teaching have probably resulted from trends in social outlook and from an increased understanding of the nature and behavior of human individuals.

The moil in which society has found itself in the past few years has increased the thinking of educators about the importance of rearing children who can do something to correct wrongs which we have accepted. The present state of affairs was precipitated upon a trend of thinking directed toward recognition of the importance of respecting the personality of each individual in the light of its potentialities for becoming effective in society. In much of the recent University instruction teachers have been helped to see that children learn better if they are interested in what they do and have a responsibility for it. Stress has been placed on the interaction of various aspects which make up the whole personality—physical, mental, emotional, and social. Children have been seen to be happy and normal when they have freedom to express themselves through the outgoing exercise of all powers. The Mental Hygiene point of view has doubtlessly influenced this educational thought to considerable extent by showing the pernicious effects of certain types of behavior which have a mechanism of cause and consequence not always readily apparent. Commenting upon the contribution of Mental Hygienists, Professor Kilpatrick says:

> "We have always known that some children are 'unaccountably bad' or distressingly sensitive or given too much to discouragement or to daydreaming. Thanks partly to Freud, but also to our own studies, we have come to see these and their like as forming a new kind of study to which we give the name 'mental hygiene.' . . . . Mental hygiene, knows the danger points, watches for signs, advising the school in advance so that such maladjustments may be avoided, and the mental health of the children safeguarded. . . . . Mental hygiene from this point of view becomes an essential part of each teacher's equipment. The time will surely come when all education for teaching will include this as a recognized part. . . . . Mental hygiene has come to stay as a part of any first-rate educational program" (1).

According to their light teachers in the past decade have attempted to answer the challenge of their critics which were frequent in educational literature of five or ten years ago pointing out "lack of definite information about children even though there might be adequate information about the psychology of teaching" and the fact that "the behavior of the child receives attention only when it interferes with what the teacher is struggling to accomplish . . . (and) provokes repressive discipline directed toward the immediate symptoms rather than interest in the cause." With the trends of the times and under the leadership of a great "Progressive Education" movement effort has been directed toward giving freedom for outward expression, happiness in pursuit of individual interest, and satisfaction in achievement rather than in subterfuge.

What this study shows, albeit incompletely, is the struggle toward new viewpoints in education, a shift in which there are still conflicting attitudes and no settled conviction. Greater basic understanding is still needed. Translated into practice many false interpretations are clear. Some teachers are so concerned about making children happy that they spoil them. Sometimes there is such an attempt to give children freedom that it sweeps beyond all bounds and results in license. Again the rights of the individual are so stressed that the good of the group is overlooked. With the increased recognition of the importance of recessive, introverted types of reaction, has appeared a consequent trend toward liberation from traditional social conduct. However, in lifting from children a strict and unreasoning external regard for God, man, and social custom, it would be unfortunate indeed if social integrity should be sacrificed. Reactionary outbursts against authority may assume less importance when judged objectively in the light of consequences to the growth of the child than they did when evaluated against the comfort, traditions, and sensitivities of the teacher, yet it may still be regarded as a serious matter for children habitually to resort to behavior of an anti-social though expressive character.

If in the apparent shift of attitudes of teachers toward the behavior of children there could be proven a universal trend toward conscientious study of the nature and needs of childhood, and of the qualities of conduct which children need for functioning in a desired society, there would be great hope for the future of education.

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Measuring Emotionality in Infants

A Tentative Experiment

KATHARINE M. BANHAM BRIDGES

PROCEDURE

AN ATTEMPT was made to measure emotionality in infants by taking records of the duration and frequency of emotional reactions during ten one-hour observation periods scattered over a month.

Twelve children in a single ward at the Montreal Foundling Hospital were the subjects of the brief investigation. The average age of the group was fifteen and a half months. The ages of eleven of the children ranged between twelve and seventeen months, while one mental defective was twenty-one months old. There were an equal number of boys and girls.

The method' of systematic observation of the children in their usual environment was adopted. Descriptive records were kept of the emotional reactions of the infants and the provoking situations. The time of each affective response was recorded in minutes and seconds, with the aid of a stop-watch. Short cries or fleeting smiles too rapid to time accurately were arbitrarily counted as of two seconds duration. Many cries and smiles satisfactorily measured lasted about so long.

The observer paid particular attention to the babies' reactions to situations which had been found to be provocative of emotion in previous studies on the emotional behaviour of infants (1). The responses were recorded in two columns, one for all forms of distress and the other for all forms of delight or enjoyment.

The distress responses consisted in tearful crying, rigid tension and arrested activity, fretful whining or grunting, furious banging, and wide-eyed staring. The responses of delight consisted in laughter, smiles, running or jumping up and down, crooning vocalization, and patting.

SUMMARY OF RESULTS

The results, when classified and tabulated, showed striking differences among the children such as might be of clinical value in follow-up studies.

The frequency and total duration of the distressful and joyous reactions were calculated separately for each child and compared with the medians for the group. See table 1. The mean times of emotional reactions for each child were also computed. See table 2.

The results showed all possible variations. One or two children exhibited very little emotion of either kind. Some showed great distress and little delight, while others were more often

TABLE 1

Individual difference in emotionality of infants

SUBJECT	DISTRESS						DELIGHT					
	Direct		Indirect		All		Direct		Indirect		All	
	Time	Fre.	Time	Fre.	Time	Fre.	Time	Fre.	Time	Fre.	Time	Fre.
A. B.	72′ 30″	17	93′ 30″	20	166′ 0″	37	0″	0	9′ 53″	9	9′ 53″	9
B. B.	3′ 36″	15	2″	1	3′ 38″	16	1′ 48″	15	1′ 12″	8	3′ 0″	23
P. B.	7′ 2″	17	27′ 20″	5	34′ 22″	22	2′ 15″	20	2′ 52″	16	5′ 7″	36
J. H.	4′ 40″	7	34″	5	5′ 14″	12	1′ 18″	13	38″	7	1′ 46″	20
J. L.	11′ 41″	11	1′ 0″	15	12′ 41″	26	1′ 12″	11	24″	7	1′ 36″	18
E. L.	3′ 11″	10	16′ 0″	4	19′ 11″	14	6′ 2″	41	14′ 5″	5	20′ 7″	46
D. M.	2′ 54″	7	1′ 10″	5	4′ 4″	12	56″	11	39″	5	1′ 35″	16
K. M.	7′ 7″	15	25″	1	7′ 32″	16	7′ 46″	17	1′ 32″	10	9′ 18″	27
C. S.	9′ 5″	28	24′ 0″	4	33′ 5″	32	2′ 10″	20	38′ 0″	16	40′ 10″	36
W. V.	0″	0	0″	0	0″	0	39″	8	40″	10	1′ 19″	18
J. W.	1′ 48″	12	17″	2	2′ 5″	14	3′ 10″	10	5′ 40″	8	8′ 50″	18
D. W.	58″	9	11″	2	1′ 9″	11	7′ 42″	42	3′ 25″	14	11′ 7″	56
Median	4′ 8″	12	47″	4	6′ 23″	15	1′ 59″	14	2′ 12″	9	6′ 58″	22

Key: Time, given in minutes and seconds, in the above table represents the total time of emotional reactions during ten one-hour periods of observation scattered throughout a month. "Fre." means the total frequency of these reactions.

TABLE 2

Individual differences in emotionality in infants

SUBJECT	MEAN TIME OF EMOTIONAL REACTIONS					
	Distress			Delight		
	Direct	Indirect	All	Direct	Indirect	All
A. B.	4′ 18″	4′ 42″	4′ 30″	0″	1′ 6″	1′ 6″
B. B.	14″	2″	14″	7″	9″	8″
P. B.	25″	5′ 28″	1′ 34″	7″	11″	9″
J. H.	40″	7″	26″	5″	5″	5″
J. L.	1′ 4″	4″	29″	7″	3″	5″
E. L.	19″	4′ 0″	1′ 22″	9″	2′ 49″	26″
D. M.	25″	14″	20″	5″	8″	6″
K. M.	28″	25″	28″	27″	9″	21″
C. S.	19″	6′ 0″	1′ 2″	7″	2′ 24″	1′ 7″
W. V.	0″	0″	0″	5″	4″	4″
J. W.	9″	9″	9″	19″	43″	29″
D. W.	6″	6″	6″	11″	15″	12″
Mean	43″	1′ 46″	53″	9″	37″	22″

delighted than distressed. Some children showed frequent outbursts of emotion which lasted only a few seconds, while others remained emotionally disturbed or excited for many minutes at a time. The four children whose emotional reactions lasted a relatively long time had also a frequency of outbursts higher than the median for the group.

Interesting results were obtained when the distress and delight responses were further differentiated into directly and indirectly expressed distress and delight. The time and frequency of these different kinds of response were calculated separately. See tables 1 and 2.

"Directly expressed" distress was taken as that manifested in tearful crying with puckered face and open mouth. All other forms of distress were loosely classed as "indirectly expressed." They consisted chiefly in arrested movement and body stiffness, pouting, grunting, frowning, and occasionally in banging. "Directly expressed" delight was considered to be that exhibited in smiles and laughter. Other forms of delight, for purposes of general classification, were counted as "indirect expressions." These included shouting, thumb-sucking, jumping up and down, running, and patting.

The writer is well aware of the arbitrariness and dubious significance of this broad classification. Inhibited movement and body stiffness might well be considered as directly expressed distress. Also jumping up and down might be considered a direct expression of delight. On the other hand, in previous developmental studies, crying and smiling have been found to be among the earliest definitive manifestations of distress and delight. They are the most fostered through social contact and experience. Other forms of expression of these major emotions develop later or become habitual due to peculiar circumstances. A knowledge of the duration and frequency of direct and indirect emotional responses, even in the above limited sense, may be of clinical value.

Further differentiation of reactions into spontaneous activity and inhibited movement would no doubt give results of interest both for clinical and educational purposes. The data collected in this little experiment were scarcely detailed or extensive enough to allow scope for such fine analysis. It was found possible, however, to spot children with a tendency to inhibition of movement during emotion, even from the time results as already classified.

An inhibitive tendency in distress was revealed by the scores perhaps more accurately than in the case of delight. For, since "indirectly expressed" distress refers chiefly to arrested movement, a high time or frequency score in this column might indicate such a tendency. The "indirect expressions" of delight, however, include some active movements. Thus a child who has a high time score under this heading may not necessarily be given to inhibitive types of affective response. On the other hand, a low score for "directly expressed" delight would mean rare smiles or laughter, the most ready and normal manifestations of delight, and would imply a certain amount of inhibition or modification of response.

A tendency towards spontaneous and active expression of emotion, or towards inhibitive responses might also be found by comparing the relative duration and frequency of reactions. Inhibited behaviour was usually of longer duration than marked activity; whereas children whose scores showed high frequency of emotional response, whether distress or delight, were those who expressed their emotion in spontaneous activity, according to the descriptive records. See subjects A. B., E. L., and C. S. in table 2.

An attempt was further made to discover "emotional perseverators" from the time results; that is, children who are slow to recover from an emotional disturbance. But it was realized that they might be found both among those whose emotional reactions were of long duration, and also among those who showed a high frequency of emotional response. For, a "hangover," from a great excitement or disturbance may manifest itself in frequent little outbursts of hilarity or distress for some time after the event.

Since the situations in this study were entirely uncontrolled, a high time or frequency score for any one child would not of necessity mean a tendency to perseveration or extreme emotionality. For, it might be merely indicative of the prolonged presence or frequent recurrence of a situation especially provocative of emotion for that child at the time study was made. This fact, however, is significant and important in itself and could be checked against subsequent scorings under different circumstances.

Although children with a tendency towards emotional perserveration, in general, might be discovered among those with high emotionality scores it was found impossible to differentiate further the various types of emotional perseverator; for example, those whose emotional adjustment to a persistent situation is slow, and those who show perseveration of emotion after the situation has changed. The rough time scores in this experiment include both these kinds of response. But, if it were so desired, time records could be kept of emotional reactions which persist after the removal of the initial provocative situation.

According to the findings of Cattell (2) it seems probable that a tendency towards emotional perservation is a handicap in "character building for reliability and tenacity of purpose." On the other hand, the instable flexibility which characterizes an "emotional perseverator" can be made a social asset. At all events the early diagnosis of such a personal idiosyncrasy would be of educational significance if not of special clinical importance.

A comment might be made here also with regard to emotionality in general. Even though a child be diagnosed as "highly emotional" with the aid of measures or ratings, this does not necessarily imply a prognosis of social maladjustment or psychoneurosis. An emotional child of ordinary intelligence can be so educated to adapt to his temperamental peculiarities as to develop into a fine and perhaps brilliant personality. Indeed it is possible that an intellectually dull child may profit from the additional drive provided by an emotional nature, if he is adequately trained.

CONCLUSION

The method of measuring emotionality in infants by timing their emotional responses during a given series of observation periods is quite simple and may have distinct practical value. Certain drawbacks must, however, always be kept in mind. The method can only be used for comparing children of the same age subjected to the same environmental circumstances. Different things, for example, are frightening or amusing to children of different age levels.

Moreover, no single rating of a child among his fellows should be taken as an indication of permanent emotional tendencies. Temperamental characteristics change continually with the environment, with health, and with social situations. But a series of such measures of emotional reactions taken at intervals of months or years might uncover certain relatively stable temperamental trends.

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Time-Sampling Techniques[1]

Willard C. Olson and Elizabeth Mechem Cunningham

THE wide-spread use of direct observation in the study of behavior has resulted in a number of requests for a bibliography of those methods which have been variously characterized as measurement by time sampling or by repeated short samples. The writers have here attempted to bring together the studies printed in English which contain descriptions, adaptations, evaluations, or general discussions of the method. The references were secured by a survey of the published literature, in addition to replies from letters of inquiry to all individuals and institutions known to have made some use of the method. In the letters of inquiry, lists including studies accepted for publication, studies completed but not published, and studies in progress were also secured. The completed studies have been included in the bibliography in those instances where there was an opportunity to examine them. In general, the references have been discussed from the point of view of their contribution to the methodology, rather than from the point of view of the contribution of the study to the specific problem presented.

SUMMARY OF INITIAL INVESTIGATIONS

Impetus to study by direct observation was given by Olson, 1926–27, working as a fellow of the National Research Council Board of Fellowships in the Biological Sciences. In studying the nervous mannerisms of children, he attempted to apply the general principles of scientific measurement as evolved in biometric work to observations of behavior. These principles include the general requirements of accurate observation; i.e., the definition of a unit, the delimitation of a field of observation, and the need for repeated samples (determinations) for accurate measurement. Thus, as applied by Olson, the "time-sampling technique" was characterized as the *systematic recording* of a definitely *delimited unit* of behavior described in terms of action over a *stated time interval* yielding *quantitative individual scores* by means of *repeated time units.*

The general procedure and results of the application of the method were first described at a meeting of the American Psychological Association, December, 1927 (39). A monograph report of the work was not available until 1929 (40), although Anderson commented briefly on the method and data of Olson's study in the report of the conference on research in child development of the National Research Council Committee for Child Development in May, 1927 (1). The monograph contains an account of the development of the time-sampling technique in its original form and its application to various categories of so-called nervous habits. In the final form used in the investigation, twenty five-minute time samples were employed and only one category of behavior observed at a time. Experimentation was conducted with time samples of five and ten minutes, and with observations on the same and on different days. Data are presented on the reliability of the method and on the distribution and incidence of habits in preschool and school children. The general principles employed in the method were adopted at a number of child research centers, with further inquiry into the range of application of the method and further critical study of the assumptions.

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[1] From the child development laboratories of the University Elementary School of the University of Michigan.

Goodenough (16) reviewed the work of Olson and presented illustrative data on the application of the general method to behavior studies in the Institute of Child Welfare of the University of Minnesota. Some experimenting was done with a technique for weighting each time unit as well as the division of one-minute observational periods into ten-second intervals. Reliability coefficients are reported for observations on physical activity, general activity, laughter, conversation, social participation, leadership, anger, dramatic play, self-help, response to food, and reluctance. Delimited definitions of overt behavior to be included in each category are not reported in detail. A brief description of Parten's approach to the study of social reactions was included in the report.

Published detailed accounts of portions of Parten's work have recently appeared. In the first report (51) data on social participation among preschool children are presented. The categories of behavior used were named (1) unoccupied behavior, (2) onlooker, (3) solitary independent play, (4) parallel activity, (5) associative play, and (6) coöperative or organized supplementary play. Each nursery child was observed for one minute each day with a systematic rotating plan of observation to insure randomness of time-sampling for the various children and for the periods of the day. Twenty one-minute samples were used to secure a measure for each child. By weighting the occurrence of behavior in each category from −3 for unoccupied behavior to 3 for coöperative play, a measure of social participation was obtained for each child. Reliability was studied by the odd-even method and by check observers. Relationships are reported between the types and quantity of social participation and such variables as age, intelligence, teacher ratings, and nursery school experience. More recent publications analyze data on leadership behavior (52) and social play (53) gathered during the course of the same investigation.

A preliminary report by Thomas and her associates (64) described the work in progress at the Child Development Institute of Teachers College.

The introduction contains a brief statement of the problems of experimental sociology. The major problems of methodology have been viewed as (1) control of the observer, and (2) the definition of units. Of the nine preliminary reports contained, those by Barker and Loomis are the clearest examples of adaptation of time-sampling techniques in the sense of the survey.

Three reports concerning methods by Goodenough (18), Olson (42), and Thomas (65), at the Ninth International Congress of Psychology, December, 1929, at Yale University, indicated considerable similarity in the general conclusions which had been reached for the fields represented. Discussion of the general method with systematic implications have now appeared in several textbooks, notably those of Goodenough and Anderson (20, p. 246 ff., 255 ff., 334, 430 ff., 534), Symonds (63, p. 23–40), and Murphy and Murphy (37, p. 214–19, p. 223–27).[2]

Distinguishing Features

Modifications of the general technique and developments from other beginnings have now become so numerous that it is rather difficult to decide what investigations shall be styled as time-sampling studies. The term "time sample" does not, of course, specify all of the characteristics of the method. That term was used by Anderson in his introduction to Olson's monograph as designating one of the prominent features of the method. Goodenough referred to the method as one of repeated short samples. Having in mind primarily the locale for the studying of problems, Olson described it as a natural history approach to the problem of measurement and described the identifying characteristics of the method.

An examination of the various studies reported suggests that a formal *time-sampling technique* will include the following features:

(1) Observation by an eye witness.
(2) Behavior to be observed defined in terms of overt action.
(3) Behavior of an individual or group observed for a stated time unit, usually short.
(4) A stated number of repetitions of the time unit employed.
(5) An individual score based upon the *number of time units* in which the defined behavior occurs, or the *total frequency of occurrence of the defined behavior* in the total observational time, or the *average frequency of defined behavior* per unit of time.

Items 3, 4, and 5 are the characteristics which, in combination, suffice to differentiate time-sampling studies from observational studies in general. Each study, however, tends to modify the general method to suit the exigencies of the problem to be investigated. Variations in method, problems attacked, age level at which directed, and conditions of collection and recording will appear in the discussion and summary of the bibliographic material.

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[2] A summary and analysis by Helen McN. Bott (9) and others of studies employing observational methods has appeared since the preparation of this manuscript.

In order to assist the discussion and to arrange the complex material for ready use by students of observational methods, the following pages have been organized so as to present a definition of terms, examples of behavior categories studied, developments in methodology, and a brief characterization of some of the major trends in the reliability and validity of the measures secured.

Terms used in time-sampling studies

The following outline represents an attempt to describe briefly some of the major practices in time-sampling studies:

- I. Definition of Behavior
  - 1. Action criterion: The observer is standardized by a description in terms of action of the behavior to be recorded for an individual.
  - 2. Impression criterion: The observer is instructed to record individual behavior on a judgment scale for a trait which may have certain points defined in terms of "trait-actions." The observer may, however, be allowed to interpret the total situation.
  - 3. Social-stimulus criterion: The observer records the behavior of an individual in terms of the reactions of others to his behavior.
  - 4. Unit of behavior: The simplest unit in which the observations were described or collected.
  - 5. Category: A coarser grouping of units of behavior on a common basis.
- II. Timing and Sampling
  - 1. Time sample: A constant length of time employed for each discrete observation of the defined behavior.
  - 2. Distribution of time-samples: A statement as to how total behavior was sampled according to the time of day, month, or year, the activities engaged in, or the systematic variation of the order of observation for children in a group.
- III. Distribution of Observer's Attention
  - 1. Individual observation: The attention of the observer is directed to one individual at a time.
  - 2. Group observation: All individuals in the group are observed simultaneously or a group record made irrespective of individuals.
  - 3. Scanning: The eyes of the observer scan the observational field in cycles in a predetermined time sequence, noting each child, situation, or material at constant intervals.
- IV. Method of Recording
  - 1. Intermittent recording: The observer makes but one entry per child during one time unit, regardless of the frequency of the occurrence of the defined behavior within the time unit.
  - 2. Continuous recording: The observer makes an entry every time the defined behavior occurs.
  - 3. Photo-recording: Photographs are made of an area or event in a predetermined time-sequence.
- V. Method of Scoring
  - 1. Time-sample score: The score for a child is taken as the total of the number of time-samples in which the behavior occurred. Commonly used in intermittent recording.
  - 2. Frequency score: The score for a child is taken as the total of recorded frequencies for the constant total time in the method of continuous recording.
  - 3. Derived score: The score for a child is obtained by dividing the "frequency score" by the number of time samples. Many variations of derived scores occur, such as the translation of scores on a regular or irreg-

    ular number of samples into occurrences per hundred observations, transmutation into age norms, grade norms, letter grades, percentiles, ratios, standard scores, etc.

VI. Conditions of Observation
    1. Conditions of observation: The physical frame, social setting, subjects, time of day, experimental variables, position of observer, mechanical aids to recording, etc.

Types of behavior studied by time-sampling methods

A survey of the major categories of behavior which have thus far been attacked reveals, as would be expected, an emphasis upon overt action. The problem of implicit significance is either ignored or inferred from the nature and social valuation of the act or elaborated by statistical interrelationships. Time-sampling techniques have been applied to the following categories of behavior:

Aggressiveness
Anger
Ascendance-Submission
Attention
Cooperation
Crying
Eating
Emotional Instability
Enuresis
Fighting
Friendship
Gestures
Job vs. Non-Job Activity
Language
Laughter
Leadership
Material Activity
Movement
Nervous Habits
Physical Activity
Physical Contacts
Play Behavior
Predormescent Starts
Quarreling
Racial Attitudes
Reluctance
Resistance
Restlessness
Self-Help
Social Contacts
Stimulus Value of Individuals
Stimulus Value of Materials
Talkativeness
Teacher Responses
Thumbsucking
Verbal Contacts
Walking
Whispering

Illustrative studies. Certain representative studies have been selected for the purpose of describing some of the problems attacked and the variations in methodology which have been introduced.

Arrington (3) has reported in considerable detail several aspects of the studies conducted at the Child Development Institute of Teachers College. Part I of her monograph is devoted to a critical examination of techniques for studying the social, material, and self components of undirected activity. Part II presents individual and normative data, the consistency of her evidence with data collected by other research workers on the same children, the interrelationship of variables, and a preliminary attempt at prognosis. The subjects of the investigation were 20 children, ranging in age from sixteen to thirty-two months at the beginning of the observation period. A considerable period of exploratory work preceded the development of a practicable technique. In the final approach to the problem, the investigator studied the following categories of behavior in children: (1) contact with material, (2) walking or other physical activity, not accompanied by contact with material, (3) absence of overt activity, (4) talking, (5) physical contact with persons, (6) laughing, and (7) crying. The behavior to be included in these classifications was described in some detail, and a code was used in recording. Two experienced observers made simultaneous observations for five-minute intervals. One observer recorded the social and the other the material activities of the children studied. At least twenty-four five-minute records were made for each child. The method of continuous recording permitted further fractionation of the time unit. Derived scores were obtained based on duration and frequency of the behavior. Reliability data are reported in detail. In terms of coefficients of correlation these were usually in the neighborhood of .90. She reports that in her work she was impressed with the necessity of dividing the total behavior complex into finer and finer units and of eliminating every element capable of variable interpretation by observers.

Earlier reports in the Child Development Monograph series by Barker (5) and Loomis (35) illustrate the development of the approaches to the same central problems as are reported in Arrington's study. Similarly, in her investigation of the initiation of social contacts by preschool children, Beaver (6) utilized a code which provided for the recording of variations of both material and verbal contacts. From twenty-four to thirty-three samples of five minutes each were collected for each child. Several types of derived scores were obtained in terms of contacts initiated and received, adult vs. child contacts, range of contacts, and ratio of contacts initiated to those received.

In her investigation of the resistant behavior of preschool children, Caille (10) secured twenty-four time samples of five minutes duration for each child. The children were observed in rotation with the series varied so that the behavior sample for a given child would fall at different times during the observational period. As a rule, a child was observed only once on a given day. Simultaneous observations were made by a second observer as a check on the investigator's reliability. Methods of recording permitted the use of total frequency scores and subdivisions of the total score in terms of resistance to adults, to children, etc.

Thomas and her associates have continued and extended their work on observational methods in connection with the program of the Yale Institute of Human Relations.

Loomis (36) has reported a preliminary application of sampling methods to work situations in industry. One person is observed at a time, five-minute samples are used with continuous recording, so that fractionation in terms of five-second or one-minute intervals may be made. A total of four hours of observational time in one of the earlier investigations has been distributed over a five-month interval. Such large categories as "job" and "non-job" activities have been studied. The problem has been to discover meaningful units and the requirements of an adequate sampling. Observations have been made in kitchens and cafeterias, and in manufacturing plants having numbers of workers at similar machines.

Arrington (4) has described the application of observational procedures to the cinema. Three observers viewed 14 films, using a local theatre as a laboratory. Records of language and physical contacts of the characters were studied both by repeated and simultaneous observations. The recording method permitted analysis in terms of five-second intervals. The study has been carried forward sufficiently to note the high percentage of agreement among observers, the mechanical difficulties encountered, and to indicate promise as a means of training observers and studying methodological problems of observational measurement. The feasibility of repetition of the situation and having mechanical checks expand the possibilities of analytic study of technical issues. In the motion picture analysis, Thomas (68) reports the use of a constant rate moving paper with an automatic time signal as an aid to the observer.

A recent comprehensive publication by Thomas, Loomis, and Arrington (69) presents in greater detail social-material-self activity patterns in young children, in a trade school group of older children, and in an adult industrial group. About one-half of the volume is devoted to the study of observer reliability as checked in a variety of ways by recording the behavior of characters in motion picture films. Preliminary reports of these activities have already been noted, but the interested reader should consult the more detailed account.

Washburn (71) has analyzed the behavior of children as they encounter a nursery school group in the Guidance Nursery of the Child Development Institute of Yale University for the first time. Three five-minute time samples were employed, and the behavior to be observed shifted with each five-minute interval. Thus, the first five minutes were devoted to social contacts and material contacts. The second five minutes were devoted to a record of gross muscular activities, and the third five-minute period to vocalization. The number of objects handled was recorded in each of the three periods. Continuous recording was practiced by a checking method, and the checks were subsequently translated into letter grades on the basis of frequency within the interval.

The technique employed by Lee (33) in a study of emotional instability in nursery school children from the University of Chicago Coöperative Nursery combines a three-minute time sample with a graphic record of shifts of mood by twelve fifteen-second divisions of the sample on a judgment scale with seven steps defined. The scale ranged from audible expression of rage or grief to audible expression of pleasure. The three-minute graphic records were distributed so as to obtain a random sample of the child's behavior. Two types of derived scores were obtained: one representing frequency of shifts of mood, and one the average mood level.

Koch and Streit (28) combine the direct observational approach using short time samples with the judgment technique characteristic of well-constructed rating scales in which steps are defined by action. In a study of 50 preschool children from the University of Chicago Coöperative Nursery, they emphasize the possibility of assigning in each brief time interval a judgment based on a general impression which may include more of the "Gestalt" than would the recording of specific overt action. It is evident in their study that useful objective data can be secured with this modification when preschool children are observed for fifteen one-minute samples scattered at intervals of about a week. Reliabilities for derived scores based on mean ratings in each interval compare favorably with other recording methods. Koch (29) has also illustrated the agreement of time-sampling data on the social adjustment of children with test data on popularity as obtained by the method of paired comparisons.

In a study of friendships among children in the Institute of Child Welfare of the University of Minnesota, Challman (11) made a record of the names of the children who were found in the same play groups. His definition of group membership required a minimum presence of fifteen seconds in an association with two or more children. Changes of fifty per cent in group membership constituted a new grouping. He insured equality of observational sampling by intermittent recording by five-minute periods. Records were also obtained by nine other observers under less systematic conditions. The number of times each child was found in a group with every other child was tabulated. A derived score was then calculated which gave the number of times per hour each child associated with each of the others. This was termed a "friendship index." Many of the current techniques for the study of friendships are involved in the recent report by Green (21) from the same institution.

Choice of companions has been studied further by Hagman (22) at the Iowa Child Welfare Research Station. A scanning technique was employed with criteria for definitions of companionship at the moment of observation. Observations were begun with a different child each day to allow for distribution of samples over the total time. A three-minute time interval was employed for each cycle of observation of the group. A derived score was obtained for the reaction of each child to each of the other members of the group in terms of the ratio of actual reactions to the maximum of possible reactions.

Dow (13) contrasted the play behavior of artistically superior and inferior children. The status of these children with reference to artistic capacities and abilities was determined by concomitant studies in the psychology of art under way at the University of Iowa. She made use of a code and observed one child for one minute, then observed the next child, and secured differentiation among the children by repeated observations on the same and many days, distributed over a period of about six months. Reliability was studied by correlation and by the percentage of correspondence between simultaneous records of observers. The conclusion that the artistic group shows greater response to play materials and equipment, when they are present, is of fundamental interest. Differences are not so marked when equipment is absent from the playground. Her comparisons of equipped versus non-equipped playgrounds show a number of conclusions in common with those of Wilker (73).

Several studies have been reported in which the actual recording was of the diary type, with an attempt to get a complete account of everything that happened, and a subsequent devising of categories for the analysis of the material.

In the study of the unsupervised behavior of a group of institutional children, Smith (59, 60, 61, 62) and Reckless (54) had observers make continuous observations of one child at a time, with a sampling of 20 five-minute observations on each child. In these studies, Smith introduces an interesting variation from the usual method of reporting reliability. For example, he has taken the record for a single child, made by two or more observers, and has analyzed the records in terms of the frequencies with which the categories are represented in the record of each observer. His coefficients thus reflect the consistency with which observers secure the same distribution of behavior items in the various categories for a single child. His coefficients represent reliability of recording and adequacy of sampling for the behavior pattern of individual children, rather than the values for the prediction of individual behavior as compared to a group. By constructing categories of varying degrees of inclusiveness, he concludes that the utilization of the larger and more inclusive categories insures more satisfactory reliability. His procedure in the analysis of the record is to take the running account, and with a code of 62 items, to code the diary record with the appropriate number.

Belcher (7), in a study of teacher-child relationships in a kindergarten, illustrated the application of time-sampling techniques to a running account of behavior collected in diary form without a pre-formulated plan for analysis. The subsequent analysis was made possible, however, because the diary had been taken for an hour a day on six different days. In connection with this material, the dependence of reliability on the coarseness of categories and the repetition of observation is again illustrated.

In a portion of her study on play behavior and choice of play materials of preschool children, Van Alstyne (70) made use of a formal time-sampling method. In the study of uses of materials and their social values, each child was observed for fifteen seconds as the time unit. The observer rotated the observations among the various materials, according to a definite list, such as blocks, clay, crayons, etc. When the list of 25 materials had been checked through in this manner, the process was repeated. Observations were thus rotated by scanning successively various portions of the observational setting. This process was repeated, so as to get a large sample of the total behavior of the child. Since variable times for the use of specific material was the problem for investigation, a constant time unit was not employed in the portion of the study devoted to securing the attention span for various types of material. Sampling was used in the sense of distributing these observations over various days and times of day.

Wrightstone (76) has adapted certain features of the method of time sampling to the measurement of some of the complex performances of children in school settings. His interest was in determining whether some of the outcomes claimed for experimental school practices could be appraised by the techniques. In his investigations, he has developed several codes designed to aid the observer in an objective evaluation of each of the groups of behavior with which he has worked. These include codes dealing with Coöperative Group Planning and Discussion, Voluntary Movement and Conference, and Pupil Participation in School Control. Observations were made simultaneously for all children in a group. The method of recording permitted the analysis of each category as a whole, or in terms of subclasses of a more specific character. Recording was continuous rather than intermittent, and time was somewhat variable. Repeated observations were employed. Reliability figures obtained to date in Grades One through Six compare favorably with other time sampling studies and with test methods. Since the behavior appraised involved pupil responses, and the conditions of observation included unequal numbers of children for unequal times, Wrightstone was led to the determination of a derived score which was obtained by dividing the actual score by the pupil's share of the total class time. This investigation is being continued and expanded and in its entirety will employ a variety of measurement methods.

Olson has continued and extended his work on time-sampling methods in the recently organized child development laboratories of the University Elementary School of the University of Michigan. Several studies have been reported growing out of the material secured in his investigation of nervous habits in children. One of the preliminary reports (41) stresses method and notes possible application to the measurement of other personality traits and to the validation of test technique. A later report (44) notes in greater detail how repeated observations differentiate the same group of children from an "all or none" description in one observation to a continuous distribution in terms of amount for twenty observations. Figures on the relationship of repeated observations to the reliability of measurement are included.

In most applications of time-sampling methods, the attention of the observer is directed primarily to the behavior of the child. In an attempt to test the usefulness of the method under a particular assumption regarding the nature of personality, Olson and Wilkinson (49) had the observer direct the attention to an associate—in this study, primarily to the teacher rather than to the child. This was done under the assumption that an individual's personality is not defined by the responses he makes to others, but rather by the responses others make to him as a stimulus. A rather coarse unit of behavior was used, namely "such marked restlessness or inattention that the teacher feels the need of speaking to the child, or recalling his attention by direct word, look, or gesture." A five-minute unit of time was used, and two hundred observations were made during the course of the year. Marked individual and sex differences were obtained with this method, and the scores showed a high degree of both constancy and reliability.

In certain instances, the occasion seems to be the primary unit for the collection of data. Episodic or diurnally fixed types of behavior are profitably studied on the occasion when the behavior may be expected to arise. The time of observation, as well as the length of observation, varies justifiably with individuals. Thus, by having observers make twenty records on consecutive days as to whether a predormescent start occurred in each of a group of 21 three-year-old children as they were falling asleep at nap time, Olson (48) secured a quantitative start score. The possibility of a start occurring in this instance is chronologically fixed in a time series, and fixed further, to some extent, by the variation of rhythms in the sleep behavior of the child. A somewhat similar situation arises in securing scores for enuresis. Thus, the same report describes the development of two types of enuretic scores based upon wet naps per hundred afternoons and wet nights per hundred. A justifiable variation in the general procedure is indicated. Scores based upon records of this type may, for methodological purposes, be called "episode scores." The latter example also illustrates the conception of derived scores, since irregularity in attendance made a statement in terms of a common number unintelligible. This, of course, is done with a full knowledge of some of the technical difficulties introduced.

Among completed but unpublished studies at the University of Michigan are those on gestures (24), talkativeness (58), language (34) (72), and eating and sleeping behavior (38) (74). Riseman has filed a preliminary report (56) of her investigation of the play and fight contacts of negro and white nursery school children on the playground. This problem is of particular interest in view of the attention currently given to racial attitudes in social and political affairs. Wilker (73) is bringing to a conclusion a series of investigations on the effects of adding or removing equipment from playground areas on the behavior of children.

At the present time, Olson and Wilker (50) are analyzing the data from an investigation in which a film roll camera was used to "freeze" each aspect of the setting at regular time intervals. Time sampling by photographic recording has a number of things to recommend it for certain studies. The cost is much less than continuous recording by motion pictures, the analytic problem is smaller, the recording of non-pertinent aspects is minimized. It is probable that the method of photo-sampling lends itself better to the study of individual behavior and individual differences in reaction to materials than to the more detailed analyses of interaction. The possibilities and limitations in several areas of behavior are being investigated.

While apparently applicable to the description of the behavior of animals in uncontrolled or semi-controlled settings, but one report of a formal use of an adaptation of the method is to be found in this summary (40, p. 61–65).

Studies in progress. Reports on research in progress were received from the University of Chicago, Winnetka Public School Nursery, University of Kansas, Columbia University, Catholic University of

America, University of Minnesota, University of California, University of Michigan, Albany State College, Cornell University, State University of Iowa, Toronto University, Yale University, University of Tennessee, and the Merrill-Palmer School. The studies reported deal with compensatory behavior, play activities, gestures, consistency of behavior patterns, emotional behavior, pupils' movements in classroom situations, pupils' oral responses in classroom situations, aggressiveness, nervous habits, ascendance-submission, laughter, crying, language, talkativeness, pugnacious behavior, eating behavior, and the evaluation of the effects of habit-training programs. In several centers, an attempt is being made to secure annual appraisals by time-sampling techniques, so that problems of growth, constancy, etc., may be attacked. No attempt has been made at a complete résumé of studies in progress in the present report. Studies completed or partially completed but not published have been included in the bibliography in those instances where there has been an opportunity to examine the manuscript.

Reliability and constancy of time-sampling methods. As for the measurement problem in general, the term "reliability" is used with somewhat different meanings in time-sampling studies. Thus, reliability may be taken to mean the amount of absolute agreement on the measurement of identical behavior, the relative agreement on identical behavior, or the absolute or relative accuracy of the score in predicting similar types of behavior on subsequent similar or dissimilar occasions. The reliability of time-sampling methods has been studied in terms of the percentage agreement of observers recording the same behavior, in terms of the totals of odd and even time samples, and by the comparison of two series of observations with a time interval between. Another technique has been the comparison of an observer's record with an objective standard, such as the motion picture.

It would be difficult indeed to state in general terms the types of reliability which may be expected. It becomes clear that the number of observations employed is a factor in determining the stability of a total measure, and, therefore, within limits, reliability is within the control of the patience of the observer. The reliability of the method also varies perhaps with the following factors: the length of the time unit employed, the behavior observed, the number of children observed simultaneously, the number of categories observed simultaneously, the fineness or coarseness of the categories, the conditions of observation, and the training of the observer. It would be premature to generalize on the direction of the effects of all of the factors, since they do not operate singly. Thus, it is conceivable that several categories with a complex coding scheme could be used satisfactorily when one child is observed at a time, while an equal degree of reliability might be obtained by using but one category and observing many children simultaneously. Such factors should be considered when the observational set-up is being made, as well as during the subsequent evaluation of the data collected.

It appears to be fair to say that, whatever method of testing reliability is employed, the consistencies found are usually high in terms of the expectancy of persons who are unfamiliar with the methods. For fairly long series of observations of frequent behavior with simultaneous observers, coefficients in the neighborhood of .80 to .90 are rather easily obtained. While these are not high for individual prediction, they compare favorably with many test methods.

Correlations between scores obtained under various conditions and at varying time intervals tend to be positive, but values vary with the types of behavior studied. Reliability figures by simultaneous observation, by an "odd-even" method, or by two series of observations near each other in time sequence, tend to be higher than constancy coefficients. This, however, is in keeping with the results of other measurement methods. Since behavior is sensitive to fluctuations in situations, scores under different conditions tend to have greater significance in the portrayal of individual differences within a group than for absolute normative statements. This means that normative data must be collected under carefully defined conditions. The sensitiveness of the method to conditions, however, also indicates a large area of usefulness in describing the effects of experimentally introduced variables.

Some methodological difficulties in studies based on the direct observation of behavior. The emphasis in time-sampling investigations has been on the study of overt action in young children under conditions in which a variety of behavior might be expected to occur. In some observational settings, particularly with older persons, the environmental controls of behavior have been so set as to restrict the field of observable action. A beginning has been made, however, on some of the narrower fields of action represented in groupings of elementary pupils (46) (76), high school (14) (69) and college students (40, p. 39), and adults in work situations (69).

The emphasis in studies to date has been on methods of investigation, individual differences, and intercorrelations of behavior. Where experimental factors have been introduced in the situations studied, the interpretation has of necessity been largely in terms of situation and response. The problem of the genesis and meaning of behavior has been attacked in several investigations and may yield increasingly to technical study. The relation of breastfeeding in infants to later predormescent starts in children (48), possible relations of verbalized fears and oral habits (40, p. 68), are illustrative of attacks on such problems on the superficial level permitted by present quantitative techniques. Mention should be made here of the work of Krout (31), who has conducted a number of preliminary studies of the relationship between overt behavior and parallel verbal stimulation, with an analytic account of possible mechanisms in terms of the individual's past history. One of his earliest reports calls attention to the needs for research on the mental correlates of overt behavior. A list of overt gestures of reputed symbolic significance is given, together with an illustrative analysis of verbal stimuli by an instructor, and concomitant response on the part of the subject observed. The systematic implication and theoretical orientation for this approach may be found in his recent book on personality (32). The interpretation of overt behavior in terms of symbolic significance requires demonstration, but investigations can be set, quite apart from theoretical bias, when methods of controlling the stimulus, recording the movements, and securing historical and introspective data are combined.

There exists a large class of problems to which some of the general principles evolved in connection with time-sampling studies apply, but to which the specific techniques for measurement as enumerated for repeated short samples are not peculiarly applicable. Thus, if the behavior unit for the collection of data is a sequence of behavior acts fitting into a pattern, and if this behavior may be expected to occur in an episodic manner without an ascertainable position in the time sequence, and also may be expected to vary considerably in duration both intra-individually and inter-individually, other methods of quantifying may be more adaptable to the problem. To go into such problems would, however, be a digression from the purpose of this paper.

Because of limitations of the observer, time-sampling studies tend to deal with categories of behavior recorded in a discrete fashion. This raises the question as to whether the dynamics of interaction can be completely and adequately described by simultaneous observers or by statistical descriptions based on the patterning and intercorrelation of variables. Progress on this problem is evident in the studies reported.

Behavior is commonly regarded as a function of both the individual and the situation. The variety of settings which must be sampled in order to secure a central picture of the responses of the individual in the same or similar situations still remains an open experimental problem.

CONCLUSION

The foregoing summary indicates a considerable amount of effort devoted to the development of observational studies by some method of repeated time samples. The results to date suggest large areas of usefulness for the methods as well as some of the technical difficulties encountered.

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The Developmental Age of Industrial School Boys

PAUL L. BOYNTON AND PAUL E. LOWE

THIS study was made on 90 boys in the sixth, seventh and eighth grades of the Tennessee Industrial School. This school is not a "reform school" as might be inferred from the name, but is a state school for dependent and what might be called mildly incorrigible children. Both boys and girls are in attendance, but are handled separately so that there was no artificiality in taking the boys separately for examination. All boys in the three grades chosen were involved in the study. The ages ranged from eleven years and nine months to nineteen years and ten months; three boys were 11; five were 12; sixteen, 13; twenty, 14; nineteen, 15; fifteen, 16; eight, 17; three, 18; one, 19. Of the total group of ninety, 38 were in the sixth grade; and 26 in each of the two remaining grades. The tests used were Furfey's Revised Scale for Measuring Developmental Age in Boys, and Otis' Self-Administering Test of Mental Ability, Intermediate Examination.

In Furfey's explanation (2) of his term "developmental age" he defines it as "the progressively increasing and non-intellectual maturity of general behavior which shows itself in the growing child's play preferences, in his fantasy life, in his choice of books and movies, in his ambitions, and, in general, in his whole behavior type." Again, the statement is made that "the existing evidence tends to show that there is little or no correlation between mental age and developmental age, if the effect of chronological age is eliminated." Still further, after mentioning the fact that developmental age scores increased with age from ages eight to twelve, Furfey says that the scores increase "more sharply from age twelve to age sixteen. . . . . It is a tempting theory that the acceleration in developmental age after twelve is due to the dawn of adolescence." He recognizes the limitations of the last interpretation or suggestion, however. With these statements and hypotheses before us certain of the findings of the present study may be particularly significant.

DEVELOPMENTAL AGE AND MENTAL AGE

Where all 90 cases were combined in one general group a correlation of +.33 ±.06 was obtained between mental age and developmental age. While this correlation certainly is too low to possess significant individual predictive value, it cannot be cast aside as indicating no relationship between the variables, or as indicating that there is *no* tendency for one to influence the other. The most interesting feature of this relationship, however, is seen after the elimination or *partialing out of chronological* age. This procedure resulted in a correlation of +.47. Since this coefficient was so strikingly high, when compared with the original coefficient of .33, an attempt was made to find what conditions in the data were most likely responsible for the increase in size. In order to make a rough survey of the situation rank order correlations were run between mental age and developmental age for each chronological age group from thirteen to sixteen, inclusive.[1] The coefficients thus obtained are shown in table 1. These data appeared to indicate that the age of 14 might be a turning point on either side of which different types of relationships might exist.

TABLE 1

	CHRONOLOGICAL AGES			
	.13	14	15	16
Correlation between *mental age and developmental age*	.11	.45	.21	.63

With the latter point in mind another general correlation was run between mental age and chronological age for all boys fourteen years of age and above. This resulted in a coefficient of +.47 ±.07. It is interesting to note that this procedure resulted in a higher final relationship and a greater increase in the coefficient than did another procedure where a correlation was run between the two variables in question for all cases with mental ages of fourteen years and above, and eleven years and less. When this new group was studied with the three middle mental age years eliminated the correlation was +.43. If the relationship between the two variables had been consistent throughout the ranges this technique should have been expected to have raised the correlation to approximately its highest point.

Since the foregoing condition was not found we are thrown back on our two correlations of +.47, one a partial and one a zero-order correlation, for our basic interpretive facts. The partial correlation of .47, when judged along with the original simple correlation of .33, would appear to indicate that the relationship between mental age and developmental age is less than the relationship between brightness and developmental age, and, further, that brightness rather than mere *mental maturity is likely to be* significantly related to a boy's responses on the developmental age scale. When we return to the other correlation of .47—where all boys of 14 years and above were used—we reach a similar conclusion. If, as many believe (1 and 3) intelligence maturity is reached at or about fourteen years of age, then the restricting of the group to those of fourteen years and above really makes all the mental ages measures of relative brightness instead of mere maturity measures. It is particularly significant that this empirical procedure resulted in a coefficient of exactly the same size, .47, as that which was obtained when the effects of chronolog-

[1] The rank order method was used for these four correlations because of the small number of cases in each age group. This insufficiency of cases rendered any method crude. Correlations were not run at higher and lower chronological age levels because of the exceedingly small number of cases in each age group.

ical age were partialed out of the general relationship by means of a statistical formula. Further, this lends confirmation to the idea that degree of brightness is a significant element in determining a child's response on the developmental age scale. At least, this appears to have been true for the boys involved in this study.

Developmental age and chronological age

Contrary to what might have been expected, in light of Furfey's statement on the point, there was no consistent relationship found between developmental age and chronological age. This is seen in table 2. Of course, the number of cases in most of the age groups was entirely too small to permit of generalization, even for a group of this specialized type. If we take ages thirteen to sixteen, inclusive, however, where the concentration is the greatest we find no consistent tendency for developmental ages to increase with advances in chronological age. In fact, it would appear from a study of the medians that for these four ages alone there is a very slight inverted relationship between chronological age and developmental age. When the age of twelve is included with the other four years, and this is the inclusive range which Furfey states is the one during which there is such a decided annual gain in developmental age, the median scores point still stronger toward non-relationship between the two variables in question. This idea is brought out with equal force when a new coefficient of correlation is computed for the 66 cases within the twelve to sixteen chronological age range. This coefficient is +.09 ±.08. These facts yield scant support to any idea that developmental age, as thus computed, can be expected to show anything even approximating a consistent increase with increasing chronological maturity during that which we might call the early adolescent years. In fact, when the entire group of 90 cases is included the coefficient of correlation between developmental age and chronological age is only +.27 ±.07. Thus for the group as a whole there would appear to be little evidence in this study to support the belief that chronological maturity can be expected to be accompanied by developmental age maturity.

TABLE 2

MEDIAN	CHRONOLOGICAL AGES								
	11	12	13	14	15	16	17	18	19
Developmental age..........	8-6	13-2	13-2	14-10	14-7	13-3	13-7	14-2	16-0
Mental age..................	12-8	12-4	11-3	12-9	12-10	11-8	10-9	11-10	10-7
Number of cases............	3	5	16	20	19	15	8	3	1

SUMMARY AND CONCLUSIONS

1. Contrary to Furfey's definition of the term "developmental age" this study tends to reveal something of an "intellectual" factor in that which the test measures.

2. Instead of there being "little or

no correlation between mental age and developmental age, if the effect of chronological age is eliminated," we find a very significant relationship. We are led to conclude that brightness, if not mental age, is significantly associated with ability to respond on the developmental age test.

3. Chronological age appears to be less closely related to developmental age than is mental age. In fact, this relationship appears to be so negligible, particularly from the standpoint of individual prediction, that it is pointless to attempt to speculate as to which measured factor is truly the dependent element in the relationship.

4. This study itself has the limitation of having been worked out on a special type of boy. In fairness to Furfey's own work we should recognize the fact that these results may indicate only that Furfey's conclusions are likely to be inapplicable for atypical populations such as the one used in this analysis.

5. If the developmental age scale is going to have practical value there is need for a more objective statement of that which it purports to measure. Its experimental validation depends on this. The present criterion is too elusive and intangible to be of great value in test standardization.

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Adolescent "Crushes"

E. B. Hurlock and E. R. Klein[1]

WHILE many psychological studies have been made of adolescent development, practically no attention has been given to an analysis of the normal fixations of this period. Many studies have been made of emotionally unbalanced adolescents and of sexual perverts but little psychological interest has been directed toward the study of the normal emotional reactions of the typical adolescent to the persons in his environment. It is the purpose, therefore, of this paper to attempt to determine the prevalence of the so-called adolescent "crush," the characteristic age at which it appears, its causes, effects and duration.

HISTORICAL SURVEY

What few studies have been made of adolescent crushes have, for the most part, been of a theoretical type and conclusions have been drawn from an analysis of a few cases. One of the earliest mentions of "crushes" is to be found in the work of Mantegazza (8) who, in discussing pathological cases, says that the emotion normally felt toward an individual of the opposite sex may suffer a change in its whole character or may be transferred to an individual of the same sex, to a lower animal or even to inanimate objects. Such a transfer, he contends, may be found in normal as well as in pathological cases.

Sanford Bell (2) is among the first to mention the normal sexual emotions of the early adolescent, but his study stops with the fourteen-year-old.

Ernest Jones (6) in analyzing some of the characteristic problems of adolescence, brings out the fact that the so-called homosexual phase is more common in adolescence than at any later age and that in different individuals, it varies greatly in intensity.

Moll (9) however, is the first psychological writer to acknowledge the "crush" behavior as a normal development. The second stage of the development of sexual impulses, which he calls the "undifferentiated stage," is one in which he claims that normal children often exhibit homosexual excitement. The object of this excitement, according to him, is often teachers, friends, governesses and school fellows. This inclination, according to him, often leads to bodily acts and to contact with the beloved person by means of embraces and kisses, without the necessary occurrence of manifestations on the part of the external genital organs.

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[1] The senior author directed the study reported in this paper and prepared the manuscript for publication; the junior author carried out the study and submitted it as a Master's Essay in Columbia University.

Young (12) maintains that active homosexuality is approached whenever large groups of girls and women are found together. He believes that both young men and women have a tendency to show marked affection for persons of their own sex, which, in time, is apt to pass into normal heterosexual relationships.

L. S. Hollingworth (5), unlike Moll (9), maintains that before the onset of puberty, the child attaches affections to persons of either sex equally. But, if a definitely heterosexual attitude is not established in four or five years following puberty, it is not likely thereafter to come naturally and normally. Hollingworth is the first to describe "crushes" from a psychological angle. She writes that "among adolescents in segregated schools, whose members of the opposite sex are absent, we have violent 'crushes' involving members of the same sex. By crush is meant that species of absorbing affection which involves jealousies and demands the exclusive response of the object to which it becomes attached."

She maintains that the vague, unlocalized drives of sex are present in crushes and that, in the absence of more appropriate objects, they find expression in this manner. She also holds that "a study of the subject would almost surely show comparative infrequency of the crush in coeducational institutions."

Chadwick (3) in her chapter on "friendships and identifications," has given one of the most recent analyses of crushes in adolescent girlhood years. The following quotation expresses her point of view.

> "The typical adolescent friendships of the 'crush,' 'pash,' or G. P. varieties, as they are popularly known at school, are *usually of the simple, effusive, direct-love* type. The two are devoted to one another. They go about together as much as possible, put their arms round each other's necks or waists, kiss each other, do everything together, and feel that this friendship will endure to the end of time. . . . . The adolescent girl is *commonly extremely* jealous of her friends. . . . . They allow their best-beloved no latitude. . . . . In fact, they behave very much the same as the majority of older, heterosexual lovers. . . . . We will be ready to admit that girls who are absorbed in the stress of a violent adolescent friendship, either with a girl of the same age, a little older, or with a mature woman, find it difficult to carry on the ordinary affairs of their daily life. . . . . *Everything else fades out, or is pushed* into the background until the blaze of this fierce passion has burnt itself out. How far these relationships go, and what actual expressions of love gratification the participants *allow themselves, naturally varies* according to the degree of freedom possessed by each for deriving satisfaction from different forms of sexual requirements and love-play connected with the several component instincts. . . . . Occasionally we *shall find these friendships taking place* among groups of several girls, friends, or school-mates, who share school days or holidays, and remain warmly attached throughout life. They may often continue this close friendship so that no other outside attachment manages to break through the union, and all the members of the little group avoid or refuse marriage, preferring their own, or rather one another's company, to any that men's society can offer them."

Arlitt (1) in her latest book, "Adolescent Psychology," has discussed the crush *phenomenon in* adolescence. In discussing emotional maturing, she brings out the following points concerning crushes: "Few *individuals* remain in the state of fixation on people of their own age and sex. Where this has occurred, and the boy enters college still in the crush period with members of his own sex as the love objects, much tact and skill are necessary to cause a transference. If it persists much beyond the twentieth year, or even if it appears to persist much beyond the eighteenth, it might be well to consult a psychiatrist in order to be certain that the transference will take place and the boy pass normally from devotion to members of his own sex to devotion to members of the opposite sex."

And, in relation to girls, Arlitt states that "girls may stay in the 'crush' stage in which their attachments are solely with members of their own sex. It is not a serious matter is this crush stage persists until eighteen or nineteen years of age provided it is gradually disappearing at this time. At the same time it is well to know that crushes should not be encouraged, and that they should not give rise to any undue excitement. Treating them as a growth stage through which all girls normally pass and the length of which is a matter partly of individual difference is probably the wisest attitude."

PURPOSE AND METHOD OF STUDY

The purpose of the study to be reported below is to determine the prevalency of the heterosexual or homosexual attachments referred to above and their outstanding characteristics. As such a study naturally involves the problem of attitudes and feelings, the information was obtained directly from adolescents, rather than from observations of them.

To obtain the desired information directly from the adolescents, it was decided to use the questionnaire method. In spite of its many limitations and weaknesses, this method, it was believed, could give more accurate information about the subject than would be possible to obtain through the use of any other method.

Two questionnaires were used for this study. One was filled out by adolescents and by those past the adolescent years who attempted to recall their adolescent experiences as accurately as they could. The second questionnaire was given to teachers and counselors at summer camps, who, in many instances, were the objects of adolescent crushes or who came in close enough contact with the adolescent years to have had an opportunity to observe the typical "crush" behavior.

The questionnaires used for this study are shown on page 66.

Subjects

Although almost 2,000 questionnaires were sent out to principals of schools, college professors, high school teachers, camp directors and counselors who had agreed to distribute them, only 559 were answered and returned. These were distributed as follows:

	Male	*Female*	*Total*
Teachers	33	81	114
Counselors	21	74	95
Pupils	148	202	350

The questionnaires were distributed in boys' high schools, girls' high schools, coeducational high schools, men's colleges, women's colleges, coeducational colleges and universities, a coeducational junior high school, a

QUESTIONNAIRE FOR PUPILS

Date..........................
Place from which this questionnaire was received......................
Instructions: Do not sign your name. Please check the answers.

1. Do you like affection? (Do you like to be liked?) Yes......No......
2. Are you affectionate toward others? Yes......No......
3. Do you make friends easily? Yes......No......
4. Have you ever had a so-called "crush" or been strongly attracted to anyone with whom you were not "in love"? Yes......No......
5. Did you feel this way about more than one person? Yes......No......
6. Were you the only child in the family the time you felt this way? Yes......No....
7. Did you confide in any friend or member of your family? Yes......No......
8. Did you have interests other than your school work? Yes......No......
9. Are you boy......Girl......

If you have been so attracted, kindly answer the following

10. Where did you meet this person?......................

11. Was this person male......female......?
12. Approximately what was his (her) age........?
13. What was his (her) status or occupation?......................

14. What was your age at the time?........
15. What was your status (pupil, camper)?......................
16. How long did you feel this attachment?......................

17. How old are you now?........
18. Were you attracted to him (her) physically............
mentally............
morally............

19. Did you attempt to copy his (her) mode of living............
clothing................
speech..................
ideas...................
mannerisms..............
vocation................

20. Did you dream about him (her)? Yes......No......
21. Were you sentimentally inclined towards him (her)? Yes......No......
22. Did you write poetry to him (her)? Yes......No......
23. Did you give him (her) presents? Yes......No......
24. In his (her) presence did you feel superior..................
at ease..................
unusually talkative........
self-conscious.............
embarrassed..............
inferior..................
tongue-tied...............
25. Did you flush or pale in his (her) presence? Yes......No......
26. When out of his (her) presence did he (she) occupy your thoughts to any extent? Yes......No......

27. Did you neglect duties because of day-dreams of him (her)? Yes......No......
28. Did you confide in him (her)? Yes......No......
29. Did this person have any influence (or give advice) upon the daily decisions you made? Yes......No......
30. Did he (she) influence important, lifelong decisions? Yes......No......
31. Did you avoid meetings with him (her)? Yes......No......
32. Did you avoid showing your admiration? Yes......No......
33. Did you try to be outstanding so that he (she) would notice you? Yes.......No......
34. Did you see as much of him (her) as you wanted to? Yes......No......
35. Did this person show that he (she) liked you very much? Yes......No......
36. Did you want to fondle him (her)? Yes......No......
37. Did you actually do so? Yes......No......
38. What do you think he thought of you?...
39. What do you think caused you to feel the way you did about him (her)?...........
40. Did you attend a boys'........girls'........coed........high school?........

Any additional information may be written on the reverse side of the page.

QUESTIONNAIRE FOR TEACHERS OR COUNSELORS

Date.........................
Place from which this questionnaire was received........................
Instructions: Do not sign your name. Please designate the correct statements by checking or completing statements where designated.

1. In what capacity are you answering this? Teacher..........
   Counselor........
   ....
2. Are you male......female......?
3. How old are you now?........
4. Have you had a pupil or pupils (campers) who have manifested profound admiration (the so-called "crush") for you? Yes......No......
5. How old were they? (average)........
6. How old were you at the time?........
7. In approximately what percent of pupils (campers) have you experienced this?........
8. Have you taught both boys and girls? Yes......No......
9. Did you find fixations to be more prevalent among boys..........
   girls..........
   neither.......
10. Did they express their fondness verbally? Yes.......No......
11. In your presence did the children feel superior..................
    at ease...................
    unusually talkative........
    self-conscious.............
    embarrassed...............
    inferior...................
    tongue-tied..............
12. Did they flush or pale? Yes......No......
13. Did they confide their personal problems to you? Yes......No......
14. Did they try to be outstanding so you would notice them? Yes......No......
15. Did you reciprocate their affection? Yes......No......
16. Did they attempt to fondle you? Yes......No......

17. How did you treat them? Did you ignore them..........
Encourage a friendship........
18. Can you explain the cause of this attachment?.......................................

Any additional information may be written on the reverse side.

medical college, among camp children and counselors, in a Jewish Sunday School and at a gathering of Christian teachers and pupils. The ages of those answering the questionnaires ranged from fourteen to forty-five years, with the majority falling within the range of seventeen to twenty-one years.

Results

Because of the difference in numbers of subjects belonging to the different groups answering the questionnaires, it was thought best to report the results obtained in terms of percentage, so that comparisons could be made from one group to another. In each case, however, the number of subjects from which the percentage figures were derived, was also reported. The data obtained from each question were treated separately since each question dealt with a specific aspect of the "crush" phenomenon.

Table 1 shows the ages at which the "crush" was experienced. It is interesting to note that while the boys show the highest percentages during the ages seventeen to twenty, the girls have the highest percentages between the ages of fourteen and eighteen.

Table 2 shows the response of teachers and counselors to ages at which their pupils or campers manifested such "crushes." Both men and women teachers and counselors agree upon the ages between fourteen and sixteen as being those during which "crushes" are most prevalent. Table 2 seems to contradict table 1 as regards the ages during which boys had "crushes" but as will be noticed later, the number of "crushes" upon teachers or counselors—among girls—predominated remarkably over those among boys; wherefore it is not surprising that the teachers and counselors find "crushes" during the ages when girls are subject to them.

TABLE 1

Age of "crush"—Pupils reporting

(Question 14)

AGES	MALE		FEMALE	
	Number	Per cent	Number	Per cent
10–11	2	1.4		
11–12			1	.5
12–13	1	.7	8	4.0
13–14	1	.7	9	4.5
14–15	8	5.4	24	11.9
15–16	6	4.1	32	15.9
16–17	8	5.4	36	17.8
17–18	18	12.2	22	10.9
18–19	17	11.5	20	9.9
19–20	22	14.9	8	4.0
20–21	8	5.4	7	3.5
21–22	5	3.4	3	1.5
22–23	1	.7	1	.5
23–24	2	1.4		
24–25				
No answer	49	33.0	31	15.3
Total.......	148	100	202	100

As will be noticed in table 3, the number of "crushes" among girls is slightly higher than those among boys but their distribution is similar. It was noticed that every male medical student had more than one "crush" while the female medical students had less, proportionately. It was remarked also that while few "crushes" were reported in the Christian schools, the positive answers were almost universal in the Jewish Sunday School.

In inspecting the Teacher-Counselor responses to the same question (table 3 B), it is interesting to notice that although the highest percentage of female teachers claims "crushes" to be prevalent in only from one to ten per cent of their classes, the next highest figure is that which designates that "crushes" are prevalent among all of the pupils. This seems to agree more fully with the response of the female counselors. Most of the male counselors have noted "crushes" among fifty per cent of their campers, while the greater number of male teachers (excluding those who did not answer the question) noted "crushes" among all their pupils.

Table 4 designates where the persons who had the "crushes" met. Both boys and girls agree with respect to two places which are most common: school and parties or dances. It will be noted here that girls met more than twice as many of the persons they fixated at school, which is an outcome of the before mentioned teacher "crushes."

TABLE 2

Age of pupil or camper manifesting "crushes"—Teachers and counselors reporting

(Question 5)

HOW OLD WERE THEY?	MALE				FEMALE			
	Teacher		Counselor		Teacher		Counselor	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Under 10					8	9.9	5	6.7
10–12	1	3.0			9	11.1	8	10.8
12–14	2	6.0	3	14.3	9	11.1	10	13.5
14–16	5	15.1	3	14.3	11	13.6	17	23.0
16–18	3	9.0			13	16.1	5	6.8
18–20					4	4.9	2	2.7
20–22								
22–25								
No answer	22	66.6	15	71.4	27	33.3	27	36.5
Total.......	33	100	21	100	81	100	74	100

These teacher "crushes" are illustrated in table 5 where only 3.4 per cent of the boys have fixated on teachers, while 21.8 per cent of the girls have such fixations. The significant figures in both columns refer to fellow students or pupils.

Table 6 gives the status of those answering the questionnaire. It is obvious that pupils or students predominate considerably.

Table 7 designates that pupils fixated mostly upon people between the ages of fourteen and twenty-one, while the teachers and counselors report most fixations while they (the teachers and counselors) were between twenty and thirty-five (table 7 B).

TABLE 3

Prevalency of "crushes"—Pupils reporting

(Questions 4 and 5)

	MALE		FEMALE	
	Number	Per cent	Number	Per cent
Never been so attracted?	42	28.4	27	13.4
Attracted once?	31	20.9	54	26.7
Attracted more than once?	75	50.7	121	59.9
Total	148	100	202	100

TABLE 3B

Prevalency of "crushes"—Teachers and counselors reporting

(Questions 4 and 7)

PER CENT OF PUPILS WHO HAVE HAD "CRUSHES"	TEACHERS				COUNSELORS			
	Male		Female		Male		Female	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
100 (all)	6	18.2	8	9.9	2	9.5	11	14.9
90–100	1	3.0						
80–90			1	1.2			1	1.4
70–80			4	4.9			5	6.8
60–70			1	1.2				
50–60			2	2.5	3	14.3	7	9.5
40–50			1	1.2				
30–40			3	3.7			1	1.4
20–30			1	1.2			2	2.7
10–20			7	8.6			4	5.4
1–10	1	3.0	13	16.0	1	4.8	6	8.1
0	2	6.1	2	2.5				
"Small"			2	2.5			1	1.4
"Negligible"			2	2.5			1	1.4
"Very few"			2	2.5				
No answer	23	69.7	32	29.5	15	71.4	35	47.3
Total	33	100	81	100	21	100	74	100

The duration of "crushes" can be seen in table 8. It would seem that most "crushes" last from one to six months, many from one week to three years, but few longer than three years. The duration of a large percentage remains questionable due to the fact that "crush" continued at the time of answering. Such papers were inspected for the present age of the subject and the age at which he had the "crush." In almost every case there was no greater difference than one year.

According to table 9 it would seem that although boys were attracted, for the most part, to the "crush" because of physical or physical and mental attraction, girls were attracted mentally. Physical, and physical and mental attractions score highly also but the mental attraction supersedes.

TABLE 4

Place of meeting

(Question 10)

WHERE DID YOU MEET THIS PERSON?	MALE		FEMALE	
	Number	Per cent	Number	Per cent
School	21	14.2	65	32.2
Camp	4	2.7	10	5.0
Out of town	5	3.4	3	1.5
Home	11	7.6	15	7.4
Places of amusement	3	2.0	4	2.0
Party or dance	22	14.9	28	13.9
Museum	2	1.4		
Street	4	2.7	7	3.5
Seashore	2	1.4		
Business	1	.7	8	4.0
Newspaper	1	.7		
Summer resort	7	4.7	5	2.5
Park	1	.7	1	.5
Church	1	.7	1	.5
No answer	63	42.6	55	27.0
Total	148	100	202	100

Any number of combinations were possible in answering question 19. Only the combinations which were checked, however, appear in the table which was prepared for this question (table 10). It is evident that the greatest number of boys and girls who answered this question copied none of the habits or attitudes of the "crush," but when they did, ideas and mannerisms show preference.

In reading table 11 it is evident that both boys and girls were at ease in the presence of the one fixated. The next significant figure is the percentage denoting self-consciousness. However, there is a marked difference between the two. It would seem that some of the responses are contradictory. This is caused by the fact that the subject

TABLE 5

Status of occupation of the person fixated

(Question 13)

STATUS OR OCCUPATION	MALE		FEMALE	
	Number	Per cent	Number	Per cent
Teacher	5	3.4	44	21.8
Counselor			5	2.5
Pupil (student)	60	40.5	53	26.2
College student	1	.7	29	14.4
Camper	3	2.0	1	.5
At leisure	1	.7	1	.5
Salesgirl	2	1.4		
Theatrical	3	2.0	5	2.5
Clerk	2	1.4		
Coach	1	.7		
Stenographer	4	2.7	4	2.0
Working girl	2	1.4		
Writer	1	.7		
Guest	1	.7		
Waitress	1	.7		
Tramp	1	.7		
Nurse	1	.7		
Business			16	7.9
Army officer			1	.5
Lawyer			3	1.5
Model			2	1.0
Artist			1	.5
Monk			1	.5
No answer	59	39.9	36	17.9
Total	148	100	202	100

had more than one fixation, each of which brought about different responses.

TABLE 6

Status of subjects at the time of "crush"

(Question 15)

	MALE		FEMALE	
	Number	Per cent	Number	Per cent
Pupil (student)	67	45.3	141	69.8
College student	5	3.4	3	1.5
Camper	13	8.7	14	6.9
Counselor	1	.7	2	1.0
Hotel guest	2	1.4	1	.5
Working girl			1	.5
Lady of leisure			2	1.0
Bellhop	1	.7		
Vacationist	2	1.4		
No answer	57	38.5	38	18.8
Total	148	100	202	100

The teachers' and counselors' responses (table 12) agree with those of pupils as regards "at ease," but the *next significant* percentage denotes that the teacher or counselor found the subject talkative, whereas in table 11 we find self-consciousness predominating next.

It is interesting to note in table 13 that while the girls and boys reporting agreed upon liking affection, being affectionate toward others, making friends easily, having other interests, *being sentimental, having the "crush"* occupy their thoughts, having the affection reciprocated, the girls show a larger percentage who confided in a friend or member of the family than did the boys; and the boys show a larger percentage who wanted to fondle the one fixated and did so than did the girls.

Table 13 B summarizes the responses to the questions which are answered by "yes" or "no." The significant figures inform us that while few men teachers or counselors recognized pupil or camper "crushes," two-thirds of the women teachers have witnessed such "crushes." It will be noticed also that few of the subjects flushed or paled; many of them con-

TABLE 7

Approximate age of the person fixated

(Question 12)

APPROXIMATELY WHAT WAS HIS (HER) AGE?	MALE		FEMALE	
	Number	Per cent	Number	Per cent
Under 14	5	3.4	2	1.0
14–18	47	31.8	32	15.9
18–21	34	23.0	53	26.2
21–25	6	4.1	28	13.9
25–30			29	14.4
30–40	2	1.4	14	6.9
40–50			8	4.0
No answer	54	36.5	36	17.9
Total	148	100	202	100

TABLE 7B

Age of person fixated at time of fixation. Counselors and teachers reporting

(Question 9)

HOW OLD WERE YOU THEN?	MALE				FEMALE			
	Teacher		Counselor		Teacher		Counselor	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Under 17					1	1.2	1	1.4
17–18			1	4.8			1	1.4
18–20							8	10.8
20–25	5	15.2	3	14.3	9	11.1	32	43.2
25–30	5	15.2	1	4.8	29	35.8	5	6.8
30–35	1	3.0	1	4.8	14	17.3		
35–40					2	2.5		
No answer	22	66.7	15	71.4	26	32.1	27	36.5
Total.......	33	100	21	100	81	100	74	100

TABLE 8

Duration of "crush"—Pupils reporting

(Question 16)

	MALE		FEMALE	
	Number	Per cent	Number	Per cent
1 week–1 month	7	4.7	9	4.5
1–6 months	25	16.9	40	19.8
6 months–1 year	15	10.1	27	13.4
1–2 years	10	6.8	37	18.3
2–3 years	8	5.4	8	4.0
3–4 years	2	1.4	3	1.5
4–5 years				
5–6 years			3	1.5
6–7 years			1	.5
7–8 years				
8–9 years				
9–10 years	1	.7		
Still continues	23	15.5	26	12.9
One night			1	.5
No answer	57	38.5	47	23.3
Total..............	148	100	202	100

TABLE 9

Quality or qualities which stimulated the "crush"—Pupils reporting

(Question 18)

	MALE		FEMALE	
	Number	Per cent	Number	Per cent
Physical attraction....	28	18.9	33	16.3
Mental attraction.......	18	12.2	72	35.6
Moral attraction.......	3	2.1	8	4.0
Physical and Mental attraction............	26	17.6	3	15.8
Physical and Moral attraction............	4	2.7	2	1.0
Mental and Moral attraction............	5	3.4	6	3.0
Physical, Mental and Moral attraction.....	12	8.1	13	6.4
No answer.............	52	35.1	36	17.8
Total................	148	100	202	100

fided in the one fixated and tried to be outstanding. It is interesting to note that while both men and women teachers report that a comparatively small per cent of their "crushes" tried to fondle them, the men and women counselors report a slightly larger percentage of children who attempted this than of those who did not.

According to table 14, miscellaneous causes of "crushes" predominate. The miscellaneous group includes various combinations of the above qualities on that table, together with other causes such as "wanted sympathy," "for companionship" and even "just an adolescent infatuation."

TABLE 10

Respects in which the one fixated was emulated—Pupils reporting

(Question 10)

DID YOU ATTEMPT TO COPY HIS (HER) —	MALE		FEMALE	
	Number	Per cent	Number	Per cent
Mode of living	1	.7	5	2.5
Clothing			3	1.5
Speech	2	1.4	8	4.0
Ideas	8	5.4	23	11.3
Mannerisms	8	5.4	12	5.5
Vocation	1	.7	7	3.5
Mode of living and ideas			2	1.0
Clothing and mannerisms			3	1.5
Clothing and vocation			1	.5
Speech and ideas	1	.7	9	4.5
Speech and mannerisms	1	.7	3	1.5
Ideas and mannerisms			7	3.5
Ideas and vocation			4	2.0
Mannerisms and vocation	1	.7		
Mode of living, speech, ideas			1	.5
Mode of living, speech, ideas, mannerisms and vocation			1	.5
Clothing, speech, ideas			1	.5
Clothing, speech, mannerisms			1	.5
Clothing, speech, mannerisms, vocation			3	1.5
Speech, ideas, mannerisms			2	1.0
Speech, ideas, mannerisms, vocation	1	.7		
All	2	1.4	1	.5
None	45	30.4	48	23.8
No answer	77	52.0	57	28.2
Total	148	100	202	100

In table 15 we see that the majority of teachers and counselors encouraged a friendship. In recording, questions 11 and 17 were marked at the same time and it was noticed that in most cases where the teacher or counselor recorded that the pupil was at ease, the next response showed that a friendship had been encouraged; where the first response was "tongue-tied," it followed that such teacher or counselor had ignored the pupil.

COMPARISON OF RESULTS WITH THE FINDINGS OF OTHER INVESTIGATORS

Although Binet considered homosexual attraction as perversions, he claimed that there was a latent pos-

TABLE 11

Reactional tendencies in the presence of the person fixated—Pupils reporting (Question 24)

IN HIS OR HER PRESENCE DID YOU FEEL	MALE		FEMALE	
	Number	Per cent	Number	Per cent
Superior	7	4.7	6	3.0
At ease	50	33.8	98	48.5
Talkative	6	4.1	8	4.0
Self-conscious	8	5.4	23	11.4
Embarrassed	2	1.4	6	3.0
Inferior			2	1.0
Tongue-tied	1	.7	4	2.0
Superior and at ease	1	.7		
Superior and talkative	1	.7		
Superior and self-conscious	2	1.4		
Superior and tongue-tied	1	.7		
At ease and talkative	5	3.4	7	3.5
At ease and self-conscious	2	1.4		
At ease and inferior			1	.5
At ease and tongue-tied	1	.7		
Talkative and self-conscious			1	.5
Talkative and embarrassed	1	.7		
Self-conscious and embarrassed	2	1.4	4	2.0
Self-conscious and inferior			1	.5
Self-conscious and tongue-tied			2	1.0
Embarrassed and self-conscious			1	.5
Embarrassed and tongue-tied			1	.5
Superior, at ease, self-conscious	1	.7		
Superior, talkative, self-conscious	1	.7		
At ease, talkative, self-conscious	1	.7		
At ease, self-conscious, inferior			1	.5
Talkative, self-conscious, inferior	1	.7	1	.5
Talkative, self-conscious, embarrassed			1	.5
Self-conscious, embarrassed, tongue-tied			3	1.5
Superior, at ease, talkative, self-conscious	1	.7		
Self-conscious, embarrassed, inferior, tongue-tied			4	2.0
Embarrassed, inferior, tongue-tied	1	.7		
None	1	.7		
No answer	51	34.5	27	13.4
Total	148	100	202	100

sibility in normal persons. From the number of girls' crushes of high school pupils on girls, we find that Mantegazza's latent possibility has become a reality. However, our results are not as convincing in their numbers as was expected by the writers.

As can be seen in table 7 A, the results of this study disagree with the statement of Ernest Jones that the homosexual stage is more often positive than negative at this age. We agreed with Jones when the questionnaire was made out, anticipating a large percentage of teacher, governess, or counselor crushes. However, the results have not justified this assumption.

Although Hollingworth does not mention the prevalency of "crushes," one would assume that they were rather frequent, as they probably were at the time at which she wrote. However, home conditions have changed so that today pupils of segregated schools have sufficient heterosexual companionship outside of the schools to overcome the lack of it in school. On the other hand, the results of this study are in accordance with her statement that "A study of the subject would almost surely show comparative infrequency of the crush in coeducational institutions," as is designated in table 7 A.

TABLE 12

Reactional tendencies of the pupils or campers in the presence of the person fixated—Teachers and counselors reporting

(Question 11)

IN YOUR PRESENCE DID THEY FEEL	MALE				FEMALE			
	Teachers		Counselors		Teachers		Counselors	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Superior					1	1.2		
At ease	8	24.2	5	23.8	30	37.0	19	25.7
Talkative	3	9.1			7	8.6	8	10.8
Self-conscious					4	4.9	4	5.4
Embarrassed	1	3.0			4	4.9	3	4.1
Inferior					3	3.7	1	1.4
Tongue-tied	1	3.0	1	4.8	3	3.7	3	4.1
At ease and talkative					1	1.2	2	2.7
At ease and inferior							4	5.4
Talkative and self-conscious					1	1.2	1	1.4
Talkative and inferior					1	1.2		
Self-conscious and inferior					1	1.2	1	1.4
Self-conscious and tongue-tied					2	2.5		
At ease, talkative, self-conscious							1	1.4
Talkative, self-conscious, embarrassed							1	1.4
No answer	20	60.7	15	71.4	23	28.4	26	35.1
Total	33	100	21	100	81	100	74	100

It is likely that some of the results of this study differ from those of previous studies because this study deals almost entirely with urban population. City people have more numerous contacts than rural people, giving them a greater choice of companions. It may be for this reason

TABLE 13

Summary of pupil's questions to be answered by "Yes" or "No"

(Question 1-3, 6-8, 20-23, 25-37)

	MALE								FEMALE							
	Yes	Per cent	No	Per cent	No answer	Per cent	Total		Yes	Per cent	No	Per cent	No answer	Per cent	Total	
							Number	Per cent							Number	Per cent
1. Like affection?	119	80.5	25	16.9	4	2.7	148	100	196	97.0	4	2.0	2	1.0	202	100
2. Affectionate toward others?	98	66.2	42	28.4	8	5.4	148	100	147	72.8	48	23.8	7	3.5	202	100
3. Make friends easily?	87	58.8	55	37.1	6	4.1	148	100	153	75.7	46	22.5	3	1.4	202	100
6. Only child?	23	15.5	101	68.2	24	16.2	148	100	32	15.8	156	77.3	14	7.0	202	100
7. Confide in friend or family?	51	34.5	79	53.4	18	12.2	148	100	122	60.3	68	33.7	12	5.9	202	100
8. Other interests?	105	71.0	29	19.5	14	9.5	148	100	160	79.2	28	14.9	14	6.9	202	100
20. Dream of him?	58	39.2	38	25.7	52	35.1	148	100	99	49.0	73	36.1	30	14.9	202	100
21. Sentimental?	72	48.6	21	14.2	55	37.2	148	100	111	55.0	49	24.3	42	20.8	202	100
22. Write poetry to him?	20	13.5	78	52.0	50	33.8	148	100	26	12.9	147	72.8	29	14.3	202	100
23. Give him presents?	38	25.67	60	40.5	50	33.8	148	100	33	16.3	139	68.8	30	14.9	202	100
25. Flush or pale?	26	17.4	71	48.0	51	34.5	148	100	58	28.7	111	55.0	33	16.3	202	100
26. Occupy thoughts?	81	54.7	14	9.5	53	35.8	148	100	134	66.3	37	18.3	31	15.3	202	100
27. Neglect duties?	30	20.3	65	43.6	53	35.1	148	100	52	25.7	117	57.8	33	16.3	202	100
28. Confide in him?	48	32.4	50	33.8	50	33.8	148	100	62	30.2	110	54.4	30	14.9	202	100
29. Influence daily decisions?	37	25.0	61	41.2	50	33.7	148	100	86	42.6	82	40.7	34	16.9	202	100
30. Influence lifelong decisions?	15	10.5	78	52.7	55	37.1	148	100	37	18.3	119	58.9	46	22.8	202	100
31. Avoid meeting him?	22	15.0	76	51.4	50	33.8	148	100	32	15.8	142	70.3	28	13.9	202	100
32. Avoid showing admiration?	43	29.1	53	35.8	52	35.1	148	100	92	45.5	78	38.6	32	15.8	202	100
33. Try to be outstanding?	57	38.5	42	28.4	49	33.1	148	100	75	37.1	96	47.5	31	15.3	202	100
34. See him as often as desired?	53	35.8	46	31.1	49	33.1	148	100	90	44.5	83	41.0	29	14.3	202	100
35. Did he reciprocate?	66	45.1	24	16.3	58	39.2	148	100	117	57.9	45	22.5	40	19.8	202	100
36. Want to fondle him?	78	53.7	16	10.8	54	36.5	148	100	67	33.1	100	49.5	35	17.3	202	100
37. Did you do so?	63	42.6	32	21.6	53	35.8	148	100	38	18.8	132	65.3	32	15.8	202	100

TABLE 13B

Summary of teacher-counselor questions to be answered "Yes" or "No"

(Questions 4, 8, 10, 12, 13, 14, 15, 16)

	MALE TEACHERS								MALE COUNSELORS							
	Yes	Per cent	No	Per cent	No answer	Per cent	Total		Yes	Per cent	No	Per cent	No answer	Per cent	Total	
							Number	Per cent							Number	Per cent
4. Ever had a crushee?	11	33.3	22	66.7			33	100	8	38.1	13	61.9			21	100
8. Taught boys and girls?	8	24.2	3	9.1	22	66.7	33	100	6	28.6	1	4.8	14	66.7	21	100
10. Did they express fondness verbally?	6	18.2	4	12.1	23	69.7	33	100	4	19.0	3	14.3	14	66.7	21	100
12. Did they flush or pale?	2	6.1	8	24.2	23	69.7	33	100	2	9.5	5	23.8	14	66.7	21	100
13. Did they confide in you?	7	21.2	4	12.1	22	66.7	33	100	4	19.0	2	9.5	15	71.4	21	100
14. Did they try to be outstanding?	8	24.2	3	9.1	22	66.7	33	100	4	19.0	2	9.5	15	71.4	21	100
15. Did you reciprocate the affection?	6	18.2	5	15.2	22	66.7	33	100	3	14.3	4	19.0	14	66.7	21	100
16. Did they attempt to fondle you?	2	6.1	9	27.3	22	66.7	33	100	4	19.0	3	14.3	14	66.7	21	100

	FEMALE TEACHERS								FEMALE COUNSELORS							
	Yes	Per cent	No	Per cent	No answer	Per cent	Total		Yes	Per cent	No	Per cent	No answer	Per cent	Total	
							Number	Per cent							Number	Per cent
4. Ever had a crushee?	55	67.9	26	33.0			81	100	47	63.5	27	36.5			74	100
Taught boys and girls?	40	29.4	12	14.8	29	35.8	81	100	35	47.3	12	16.2	27	36.5	74	100
Did they express fondness verbally?	25	30.9	29	35.8	27	33.3	81	100	32	43.2	15	20.3	27	36.5	74	100
Did they flush or pale?	10	12.3	41	50.6	30	37.0	81	100	11	14.9	27	36.5	36	48.6	74	100
13. Did they confide in you?	36	44.4	18	22.2	27	33.3	81	100	39	52.7	7	9.5	28	37.8	74	100
14. Did they try to be outstanding?	35	43.2	19	23.5	27	33.3	81	100	35	47.3	12	16.2	27	36.5	74	100
15. Did you reciprocate the affection?	23	28.4	30	37.0	28	34.6	81	100	23	31.1	24	32.4	17	36.5	74	100
16. Did they attempt to fondle you?	18	22.2	35	43.2	28	34.6	81	100	23	31.3	22	29.7	29	39.2	74	100

that we find less homosexual fixations than had been anticipated. Numerous and varying interests in city life may explain why, although the percentage of those having crushes is high, it is not quite so universal as had been expected.

TABLE 14

Causes of "crushes"—Pupils reporting

(Question 39)

WHAT DO YOU THINK CAUSED YOU TO FEEL THE WAY YOU DID ABOUT HIM OR HER	MALE		FEMALE	
	Number	Per cent	Number	Per cent
Personality	8	5.4	17	8.4
Physical appeal	7	4.7	8	4.0
Mental attraction	10	6.8	22	10.9
Physical appeal and looks			10	5.0
Miscellaneous	29	19.6	63	31.2
Don't know	17	11.4	12	6.0
No answer	77	52.0	70	34.7
Total	148	100	202	100

TABLE 15

Manner of treatment of those who had "crushes"—Teachers and counselors reporting

(Question 17)

HOW DID YOU TREAT THEM?	MALE				FEMALE			
	Teachers		Counselors		Teachers		Counselors	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Ignored them	5	15.1	1	4.8	14	17.3	6	8.1
Encouraged friendship	7	21.2	6	28.6	36	44.4	39	52.7
Acted casually					4	4.9	1	1.4
No answer	21	63.6	14	66.7	27	33.3	28	37.8
Total	33	100	21	100	81	100	74	100

SUMMARY

In the material presented above, the following outstanding points were noticeable:

1. Most adolescents have one or more crushes upon people of approximately their own age but of the opposite sex.

2. Crushes, in general, last from a month to three years.

3. They are motivated by various reasons, mental and physical predominating, such as a desire for the companionship of someone of the same mental status, the appreciation of one gifted with unusual talent, the recognition of facial beauty or bodily grace, or the desire for sympathetic understanding which would incorporate both the mental and physical phases.

4. They do not influence the normal mode of behavior of the subject.

5. They are more prevalent among girls than boys.

6. Where they are homosexual in their expression, it is among girls almost entirely.

Conclusion

Although at the beginning of this study it was anticipated that teachers and counselors would be the objects of crushes, this assumption has proven to be incorrect. Evidently the old-fashioned "crush" of a pupil for his teacher or a camper for his counselor (which was often homosexual) has given way to a more modern "crush" which does not have as its goal the detailed and studied reproduction of voice, mannerisms, dress, ideals, et cetera, that was prevalent formerly.

Since the time in which previous educators wrote on this subject, conditions in the schools and homes have changed, coeducational schools have become popular and there has been less restriction in the home and since adolescents are restricted no longer in their companionships, it is natural that their fixations tend more towards heterosexuality than homosexuality as was the case due to very strict supervision of companions at the time in which most of these educators wrote.

However, we do find that camp life, where children and counselors are segregated for a stretch of two months, is conducive to "crushes" since the child has no outside or heterosexual contacts during the camp season.

We conclude, therefore, that if a child is the product either of a modern home or of a coeducational school of today, his adolescent fixations, if any, are likely to be directed heterosexually to a person of approximately his own age and are unlikely to effect his general mode of living or behavior to any appreciable extent.

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The Attendance of Nursery School Children

Harold H. Anderson

REGULARITY of attendance is a problem of first importance in the administration of any preschool, but especially is this true in those preschools that are maintained primarily for research purposes. When children are absent, overhead expenses go on just the same and research workers are often interrupted or obliged to extend their studies over longer periods of time. It is also quite probable that absences disturb the progressive development of child attitudes toward fundamental routine habits and delay the child's progress in social interplay. As a by-product of another study, a comparative analysis was made of the reasons for absences in the several groups of children enrolled in the preschool laboratories of the Iowa Child Welfare Research Station during the year 1930–1931 and in one group of three-year-old children enrolled during 1931–1932. Comparison is made between groups and between these records and four other published reports on nursery school attendance.

The preschool laboratories of the Iowa Child Welfare Research Station in 1930–1931 consisted of 4 age groups of children of two, three, four, and five years respectively. There were 2 groups of five-year-old children, one attending in the morning and one in the afternoon. These groups were designated respectively as First Group, Second Group or Home Laboratory, Third Group, and Fourth Group or Junior Primary. The total enrollment for the four groups for the year was 103. Second Group, which was included in the records for a two year period, attended from 9 A.M. to 3:30 P.M., having lunch and an afternoon nap at school. The other groups attended half days only.

A number of selective factors determine the enrollment. The children must be in good health and of average or superior intelligence; the parents must be able to pay the enrollment and food fees and be willing to cooperate with the school. About half the children come from families of graduate students or university staff members. Children are usually brought by the parents in cars, though a number come in taxis and some walk. Each morning on arrival they are given an inspection by a graduate nurse. If a child comes with signs of nasal discharge or of inflammation or infection of any kind, he is sent home. The nurse keeps in contact, usually by telephone, with the parents of absentees. Separate attendance records are kept by the nurse and by the head teachers of each group. Original records kept by the teachers are sent every three weeks to the office of the Director of the Station, carbon copies remaining in the files of each group.

A child is counted absent if he fails to come to school, if he is not accepted by the nurse at morning inspection, or if after he has been accepted by the nurse he is sent home for any reason within the first hour. Reasons for absences are reported by the preschool nurse, the family physician, or the parent. Groupings of causes of absences have been made after the suggestions of the preschool nurse.

Table 1 shows the ages of the children, total number of days of school, number of children, mean daily enrollment, mean daily attendance, total child days enrollment for the year, total child days attendance, total number of absences, and the mean per cent of attendance. Table 2 shows the causes of absences for the preschool children by groups for the year 1930–1931 and for the Second Group for 1931–1932. The total for all groups is also given. Comparable data for three other nursery schools which were obtained from their respec-

TABLE 1

Analysis of preschool attendance

GROUP	YEAR	AGE	CHILDREN	TOTAL DAYS OF SCHOOL	MEAN DAILY ENROLLMENT	MEAN DAILY ATTENDANCE	TOTAL CHILD-DAYS ENROLLMENT	TOTAL CHILD-DAYS ATTENDANCE	MEAN DAILY PER CENT OF ATTENDANCE	TOTAL ABSENCES
Iowa Child Welfare Research Station:										
I	1930–1931	2 years	16	163	14.7	12.0	2394	1964	82.04	430
II	1930–1931	3 years	23	163	17.5	13.1	2852	2136	74.89	716
III	1930–1931	4 years	25	163	23.5	19.8	3835	3232	84.28	603
IV (A.M.)	1930–1931	5 years	22	162	20.8	17.3	3374	2799	82.96	575
IV (P.M.)	1930–1931	5 years	17	162	15.0	12.3	2431	1999	82.23	432
All	1930–1931		103				14886	12130	81.49	2756
II	1931–1932	3 years	21	165	19.4	15.8	3201	2615	81.69	586
St. George's School	1926–1927		14	108			2304*	1519*	65.90*	584
Washington Child Research Center	1928–1930	22 to 42 months	71						71.50	
University of Minnesota Institute for Child Research:	1925–1926**									
I		27 months	28	*112*		*19.0*			97.60	
II		45 months								
Sixty-Three Nursery Schools	February, 1930				18.8				86.10	

* Data for three terms indicated.

** November 12, 1925 to May 14, 1926.

tive attendance reports are arranged in table 1. The mean enrollment and mean per cent of attendance are also given for the last five days of one week in February, 1930 for 63 nursery schools as reported to the White House Conference on Child Health and Protection (3).

Tables 2 and 3 show what absences are due to common colds in percentages of all absences and of total enrollment. The causes of absences are arranged with medical reasons preceding nonmedical in the tabulation.

Figure 1 divides the per cent of enrollment for the respective groups represented in tables 1 and 2 into segments showing the mean per cent of attendance for the periods of enrollment reported, and the per cent of the total number of child days enrollment in which absences are due to colds.

TABLE 2

Analysis of causes of absences in the Iowa Child Welfare Research Station

CAUSES OF ABSENCES	YEAR						
	1930–1931						1931–1932
	Group						
	I	II	III	IV A.M.	IV P.M.	All	II
Common cold	329	428	294	308	177	1536	434
Per cent of all absences	76.5	59.8	48.8	53.0	41.0	55.7	74.1
Per cent of total days enrollment	13.7	15.0	7.7	9.1	7.3	10.3	13.6
Temperature	8	8		1	2	19	1
Tonsilitis	5	5	5	3		18	
Croup	6	6		2	6	20	12
Laryngitis	5	6		20		31	9
Bronchitis	2	39			5	46	
Intestinal disturbances	7	35	24			66	5
Stomach upset	4	31	6	13	7	61	20
Eye infections (sty)		2	17	14	5	38	24
Ear infections and mastoiditis	45	65	50	22	31	213	5
Skin eruptions	2	9	1	1	1	14	
Tonsillectomy			5			5	7
Asthma				3		3	5
Scarlet fever	5					5	
Measles					16	16	
Chicken pox			25	14		39	
Whooping cough		10	10	10	45	75	
Exposure to contagious disease			27	64	18	109	
Miscellaneous medical treatment			11	1		12	
Accidents			3	18		21	1
Parents' convenience	10	63	98	52	87	310	52
Fatigue, indisposition	1	9	2	14	3	29	2
No reason obtained	1		25	15	29	70	

An important finding in table 1 and in figure 1 is the difference between

Second Group and the rest of the school. Excepting this group, the mean per cent of attendance for 1930–1931 hovers very close to the mean for all groups. The per cent of absences due to colds is about evenly matched for the two- and three-year-old children, but is greater for them than for the older children. Second Group, however, has a considerably greater per cent of absences due to causes not so prevalent in First Group.

TABLE 3

Analysis of causes of absences in other nursery schools

CAUSES OF ABSENCES	ST. GEORGE SCHOOL	WASHINGTON CHILD RESEARCH CENTER	UNIVERSITY OF MINNESOTA INSTITUTE FOR CHILD RESEARCH**
	Year		
	1926–1927	1928–1930	1925–1926*
Common cold	302		515
Per cent of all absences	51.7	57.0	
Per cent of total days enrollment	18.5	16.2	
Temperature			4
Croup			9
Stomach upset			8
Ear infections			118
Mastoiditis			13
Tonsillectomy			17
Measles			109
Chicken pox			89
Whooping cough			29
Parents' convenience			13
Fatigue, indisposition			2
Miscellaneous			60

* November 12, 1925 to May 14, 1926.

** For groups I and II.

It must be remembered that the high percentages of absences due to colds would probably be reduced at the public school age. Many children excluded for running noses had no other symptoms of illness and were quite able to get about and play. The question still remains unanswered to what extent the generally rigid nursery school requirements are really preventive.

The attendance report (2) from the Nursery School Division of the St. George's School for Child Study at Toronto covers in some parts two terms and in others three terms of the school year 1926–1927. Some recalculations from the data presented were made in order to make comparisons with the Iowa attendance reported here. The per cent of absences due to colds given in this study for the Toronto school is not the same as that given in the Toronto report. For example, the Toronto report says, "All of these 15 children suffered from 'colds,' the amount of time lost ranging from four to forty-two days, or an average of over 20 school days out of a possible 108. Briefly, three-fourths of all the time lost and practically one-fifth of all the available school time is monopolized by this condition, although in only about half the cases was the condition considered to be sufficiently serious to seek the aid of a physician" (2, p. 156).

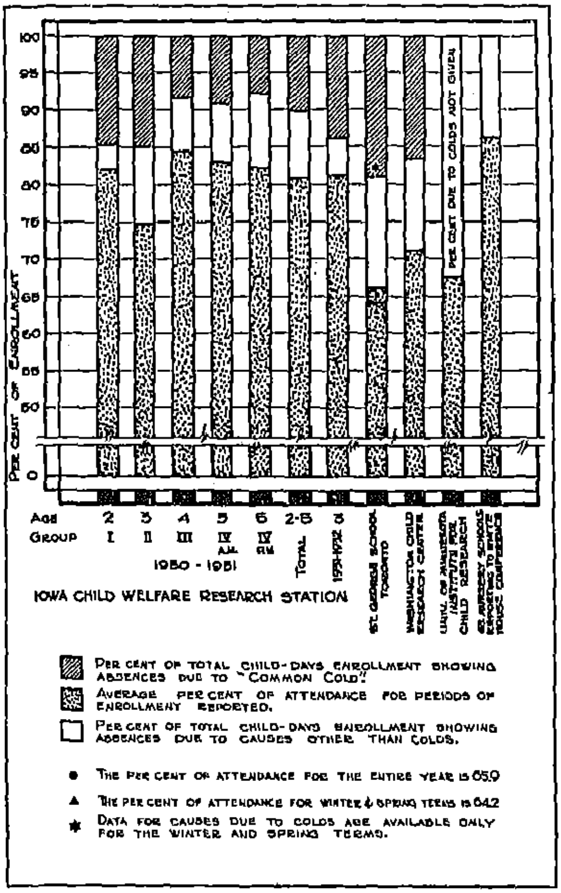

FIG. 1. PER CENT OF ENROLLMENT, ATTENDANCE, AND ABSENCES DUE TO COLDS FOR FIVE GROUPS OF CHILDREN ATTENDING THE PRESCHOOL LABORATORY OF THE IOWA CHILD WELFARE RESEARCH STATION DURING 1930–1931 AND ONE GROUP ATTENDING DURING 1931–1932 WITH COMPARISONS WITH THE NURSERY SCHOOLS AT THE ST. GEORGE'S SCHOOL FOR CHILD STUDY AT TORONTO, THE WASHINGTON CHILD RESEARCH CENTER, AND THE UNIVERSITY OF MINNESOTA INSTITUTE FOR CHILD RESEARCH

The possible attendance for the two terms reported was 108 days, but the actual days attended varied considerably per child. If, instead of averaging means, the per cent of absences due to colds is computed from the original data, the "three-fourths of all the available school time" lost to colds becomes only 51.71 per cent or slightly over half. The Toronto report considerably magnifies the rôle of colds as causes of absences in their nursery school group. However, even with this correction, colds at Toronto occupy a greater segment of the enrollment column in figure 1 than for any other group reported. This is also true of absences due to causes other than colds; the per cent of attendance at Toronto is the lowest among the various groups. The figure of 18.5 per cent of total days enrolled showing absence for colds is also greater than for any other group.

The Washington Child Research Center (4) reports attendance for two years, 1928–1930, with a total enrollment of seventy-one. The per cent of attendance of 71.5 for the two years is below all the Iowa groups, although 5.6 per cent above that given for Toronto.

John E. Anderson has given a very detailed report (1) of attendance at the Nursery School of the Institute for Child Research at the University of Minnesota for 1925–1926. Some of the causes of absences are reproduced in table 3 in spite of the fact that there are probably some arbitrary differences in classifying causes of absences. It is apparent that ear infections and contagious diseases, some of which were reported as epidemic in Minneapolis for that winter, accounted for much in keeping the mean attendance down to 67.6 per cent. An interesting detail is the low ratio of absences due to parents' convenience as compared with the Iowa children.

Sixty-three nursery schools reported to a committee on Nursery Education of the White House Conference on Child Health and Protection. Blanks were distributed and filled out as of March 1, 1930.[1] The questionnaires obtained "attendance in the week preceding that in which the Final Blank was filled out and the enrollment that week" (3, p. 59). The per cent of attendance given by these 63 nursery schools was 86.1 per cent. This is higher than the attendance records of any of the groups considered here.

The question is raised as to why the White House report gives a mean per cent of nursery school attendance so much higher than the other means reported in table 1 and illustrated in figure 1. Can it be that these nursery schools maintained for research are consistent though inadequate samples? Do parents withdraw children sooner in the case of illness in the average nursery school and thereby relieve the records of so many absentees? Do these four research nursery schools possibly have more rigid daily health inspections and reject more children for minor illnesses than is done in the average nursery school? Or is there some explanation in the fact that these 4 nursery schools are reporting for entire terms or years, while the 63 are reporting for only one week in March, 1930? The means for February and March at the Washington Child Research Center (4) are below the per cent of attendance for the year, whether each year reported is taken separately or both together.

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[1] The White House Conference Report on Nursery Education (3, p. 15) gives March 1, 1929, but the writer believes almost certainly that this is an error and that these questionnaires were distributed in 1930. The Foreword states (3, p. XV) that the first meeting was held December 13 to 14, 1929 at which "a report of projects within its field which might be undertaken by the Committee was submitted."

The material does not warrant making too strict comparisons between the attendance records of the various groups here considered. The numbers are small, the groups vary in age and number, and the reports are given for different years.

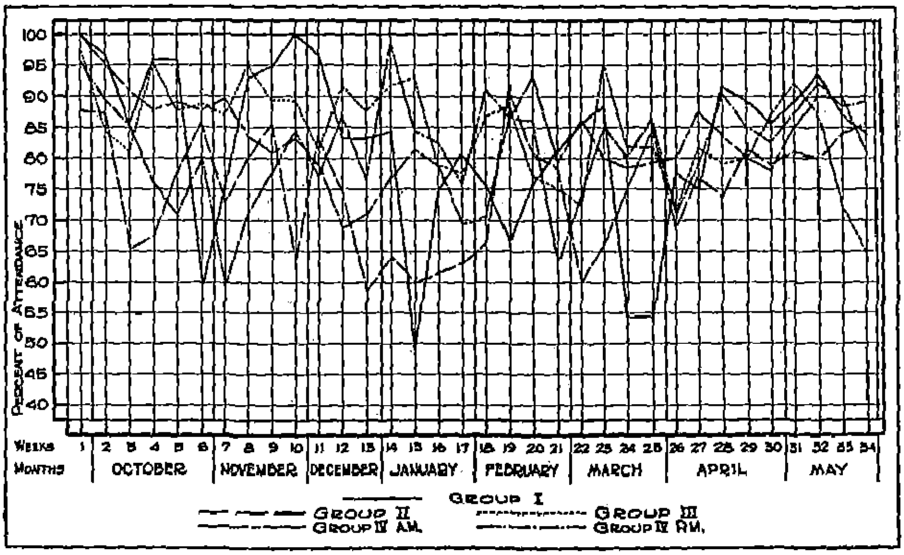

FIG. 2. WEEKLY PERCENTAGES OF ATTENDANCE FOR EACH OF FOUR AGE GROUPS OF PRESCHOOL CHILDREN, 1930–1931

Because the question has been raised as to seasonal attendance, figure 2 is given showing the weekly per cent of attendance throughout the school year for respective groups of Iowa children. In figure 2 the curves are superimposed for comparison. With the curves blocked off in monthly segments, April and May show much greater consistency in the curves than the other months. Nearly every peak for one group is offset by some valley in another. The latter part of January shows most of the curves proportionately low. The early part of February, with the exception of First Group, shows the curves tending upward. However, the general effect of the curves in figure 2 is one of contrast.

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Brief Reports

Standards of Development in Terms of Increments

IN SPITE of the energy which has been devoted to the construction of standards of development it is not difficult to point out inadequacies at many points. The available standards would be vastly improved if clearly defined homogeneous populations were employed, if not merely the abnormal fraction of one per cent but also the ten per cent who have received the least adequate care or who have histories of conditions known to retard growth were eliminated, if separate standards were set up for sub-groups of such selected populations as tall versus short or early versus late maturing children, if more care were given to the statistical statement of the norm in terms of averages, standard deviations, quartiles, and where necessary the 90th. and 10th. percentiles, and if more serious study were given to the significance of deviations from the average. Finally, standards would be much improved if they were stated in terms of annual or semi-annual gains and increments, in terms of progress rather than status. The judgment is ventured that future work on standards of development will and must move in the direction (a) of stating standards in terms of increments and (b) of sparing no labor to determine the significance of deviations from the average of such standards.

This paper employs measures of height and weight for the purpose of illustrating a procedure and point of view which should be applied to all the many aspects of development and growth. The basic data were taken from Bird T. Baldwin's "Physical Growth and School Progress," U. S. Bureau of Education, Bulletin 1914, No. 10, in which he gives the heights and weights obtained from examinations repeated annually over a period of six years on a favored group of 50 boys and 50 girls originally age 7 and of 50 boys and 50 girls originally age 12. Table 1 presents the average number of pounds which will be gained in a year by sex, by age groups, and by weight groups together with the standard deviations of these gains. Thus, boys age 15 and 16 and weighing one hundred thirty or more pounds will gain in a year on the average 9.5 pounds with approximately 68 per cent of the gains falling between four and fifteen pounds. The heavier boys gain fewer pounds than do the lighter boys of these ages. Similarly, girls age 15 and 16 and weighing one hundred thirty or more pounds gain on the average 2.8 pounds while those weighing eighty to eighty-nine pounds gain on the average 6.2 pounds. The large standard deviations in comparison with the average for girls age 15 and 16 indicate that it is not unusual for them to lose weight during a period

TABLE 1

Pounds which will be gained in a year by sex, age, and weight groups

WEIGHT AND AGE	BOYS		GIRLS	
	Mean	St. Dev.	Mean	St. Dev.
Age 15 and 16				
130–	9.5	5.5	2.8	4.8
120–129	11.1	5.5	3.8	4.9
110–119	11.9	6.3	5.0	5.4
100–109	13.3	6.3	5.1	5.6
90– 99	14.3	6.5	5.7	6.4
80– 89	15.7	5.5	6.2	6.2
Age 13 and 14				
120–			6.1	5.8
110–119	12.5	6.7	7.6	6.2
100–109	13.3	6.1	9.8	6.1
90– 99	13.3	5.6	10.7	5.9
80– 89	12.1	5.3	10.8	5.7
70– 79	10.9	5.1	11.2	4.6
60– 69	9.7	5.1	11.4	4.3
Age 11 and 12				
100–	12.5	5.5	11.5	6.0
90–99	10.8	5.1	11.4	4.9
80–89	8.9	4.5	11.2	4.8
70–79	7.9	4.0	10.5	4.6
60–69	6.9	3.0	9.6	3.7
50–59	5.7	2.3	8.3	3.9
Age 9 and 10				
80–	8.7	3.7		
70–79	7.8	3.1	9.0	4.1
60–69	6.7	2.8	7.3	4.0
50–59	5.2	1.9	6.2	3.8
40–49	4.2	1.6	4.3	3.2
Age 7 and 8				
60–	6.7	3.2	7.2	3.8
50–59	5.7	2.8	5.4	3.0
40–49	4.9	1.9	4.5	1.8

TABLE 2

Inches which will be gained in a year by sex, age, and height groups

HEIGHT AND AGE	BOYS		GIRLS	
	Mean	St. Dev.	Mean	St. Dev.
Age 15 and 16				
66–	1.6	.9	.3	.5
64–65	1.9	.9	.6	.5
62–63	2.5	1.0	.7	.5
60–61	3.0	1.0	.7	.6
58–59	3.3	.9	.8	.7
Age 13 and 14				
64–	2.5	1.0	.9	.7
62–63	2.7	1.0	1.3	.7
60–61	2.6	.9	1.7	.8
58–59	2.6	.9	1.8	.8
56–57	2.4	.8	2.1	.8
Age 11 and 12				
All cases	2.0	.7	2.4	.7
Age 9 and 10				
All cases	1.9	.4	2.1	.5
Age 7 and 8				
	2.0	.6	2.1	.5

of a year. In the age range 13 and 14 the heavier boys gain more than the lighter ones, while the heavier girls gain less than the lighter ones. In the age range 7 and 8, 9 and 10, and 11 and 12 the heavier children consistently gain more than the lighter children and the variabilities of their gains are consistently greater. Table 2 presents similar data for height. In the age range seven to twelve, the averages and standard deviations for different statures have been omitted since the data indicate that the correlations between height and gains in height are negligible.

On the basis of these data it is hardly

necessary to point out that, if standards of height and weight in terms of increments are to be constructed, such standards should take account of initial height and weight and of different variabilities for each sex, age, and weight and height class. Since some of the distributions of increments are skewed, the basic data should include medians and quartiles and possibly the 90th. and 10th. percentiles in addition to means and standard deviations. Since many school systems have been obtaining height and weight data at regular intervals it should not be difficult to construct such standards on the basis of many thousands of cases and to distinguish in addition socio-economic, rural-urban, and racial standards.

If such standards are to be constructed, however, it is most important to know beforehand the significance of deviations from such standards. Suppose that Johnny age 10 weighs 45 pounds and at age 11 weighs 50 pounds; while 50 pounds at age 11 is far below normal and while a 5 pound gain is less than average for boys age 10, the 5 pound gain is nevertheless better than the average for boys of his weight at age 10. That is, the hypothesis is offered that increments provide a better index of satisfactory development than the conventional height-weight-age-sex tables such as the Baldwin-Wood-Woodbury tables.[1] Moreover, standards in terms of increments should be more practicable of application than procedure developed by Franzen (1). A test of the hypothesis requires the study of increments in relation to socio-economic status, morbidity, adequacy of diet, defects, dental caries, nutritional status as judged by a physician, and nutritional status as estimated by Franzen's procedure. Minor problems concern the most suitable period of time whether three months, six months or a year and the most sensitive and significant dimension whether height or weight, or chest depth or circumference of upper arm.

Theoretically, standards in terms of increments have many advantages over the familiar standards in terms of averages by age and sex. They emphasize progress rather than status. They measure primarily environmental factors operating over a short period of time whereas the conventional standards measure a complex of hereditary, constitutional, and environmental factors acting and interacting over a period of years. The variability of annual increments is necessarily much less than the variability of the gross measures; hence, standards in terms of increments should be more precise and specific.

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[1] Easily the best statement of the present status of the height-weight tables appears in editorial in Jour. Am. Med. Assoc., 1933, 101, 369–370 and reprinted in full in Am. J. Phys. Anthro., 1933, 18, 155–157. Fourteen references to the literature are given.

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The Age at Walking of Children Who Run on All Fours

HŘDLIČKA in his book "Children Who Run on All Fours" is of the opinion that the habit of running on all fours has the effect of producing a delay in the onset of walking (p. 48). The only evidence which he offers in support of this view is a few expressions of opinion from his informants. It is obvious that if children who use the quadrimembral mode of progression are late walkers, the retardation in walking may be associated with rather than caused by the peculiar pre-walking locomotion. But however that may be, it does seem possible that Hřdlička's subjects may be unusual with respect to the age at which they begin to walk. It is surprising therefore to find that this author presents no average, median or distribution for the age at walking of his subjects. Inasmuch as Hřdlička's data, which consist of communications from volunteer correspondents, have been published in full in his book the facts are available to anyone who will examine each of the letters.

I have been sufficiently interested to do this little task, which is chiefly clerical in nature. In compiling these data I attempted to find the age at first walking alone; that is, walking without aid from furniture or persons. Wherever possible the age at which the child took his first step was secured, although where this performance was not specified the age at "beginning to walk" was taken.

Not all of the letters contain the desired information. Data were obtained for 217 children. The distribution of the ages is presented in table 1. This table shows the range of the age at walking to be from eight to twenty-four months. The average age proves to be 12.97 months.

If we compare this average with averages secured by roughly comparable methods of research by other investigators we find no support for the claim that the children who run on all fours are retarded in walking. Terman (5) found that the average age at which the first step was taken was 12.94 months for 565 of his gifted children. The average age at which "several steps" were taken for the same children was 14.12 months. M. E. Smith et al. (3) found the mean age at the first step for 109 Iowan children to be 13.47 months and for 725 children of various races in Hawaii 13.25. Only the average of S. Smith (4) for 831 Seattle children for "walking alone" (12.77 months) is slightly lower than the average of Hřdlička's group.

In view of the fact that differences in technique are present in the comparison of any two of these groups, it seems unwise to emphasize the differences between the means. Rather it seems amazing that the procedures which have been used should have secured results which are so nearly identical. The differences are very small in comparison with the difference found by Abt et al. (1) between dull and normal children. We must conclude that the children reported by Hŕdlička are not markedly different from unselected children with respect to the age at which they begin to walk.

TABLE 1

Distribution of ages at walking

AGE	NUMBER OF CASES
months	
8- 8.9	1
9- 9.9	9
10-10.9	20
11-11.9	29
12-12.9	60
13-13.9	32
14-14.9	30
15-15.9	14
16-16.9	8
17-17.9	1
18-18.9	8
19-19.9	2
....	..
22-22.9	2
23-23.9	1

It seems to us that in raising the question of the age at walking of groups of children with different kinds of pre-walking locomotor habits, Hŕdlička has called the attention of psychologists to an interesting problem. In studies of walking to date we find that the onset of this behavior has been related to height, weight, intelligence, race, climate, sex, health, and nutrition but that the present topic has been completely ignored. With respect to the rôle that learning plays in the development of walking, the relation of walking to various kinds of practice would be particularly interesting to discover. It is curious that no one has attempted to find the influence upon walking of the "baby walker," for instance. While the habit of running upon all fours cannot be imposed at the will of the experimenter, there are doubtless many other pre-walking locomotor habits which the investigator can easily control.

Wayne Dennis.

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Performance of Children in Stutsman Tests

DATA, obtained from the administration of the Stanford Revision of The Binet-Simon Scale and The Minnesota Preschool Scale to young children at The Child Institute of The Johns Hopkins University over a period of several years, have recently appeared in this journal (1). It is the purpose of the present paper to present supplementary information obtained during the same period from the same group of subjects regarding their performance on certain of the tests in The Merrill Palmer Scale.

In its revised form The Merrill Palmer Scale, (2) contains 93 items applicable to children from 18 months to 6 years. Tests range from the manipulative activities such as tower building, to simple language tests, such as repeating words or word groups. The final score, which takes into account both refusals and failures, is calculated on a point scale basis. By means of tables this raw score may be translated into a mental age equivalent, a percentile equivalent, or a standard deviation equivalent for each age level.

Stutsman in an earlier study (3) gives percentile scores for each age level for the individual tests. After the tests have been administered to the child, in order to successfully interpret the results obtained, the scores made by the child on any given test are compared with the percentile scores for his age level. This comparison shows whether or not his performance is better, equal to, or worse than the average performance for his age level as indicated by the tables.

When The Merril Palmer Scale first appeared all the items suggested were given to the children of The Child Institute. As the problem of suitable tests for preschool children was at that time studied by the application of many types of tests the preliminary study indicated that a selected group of items from this scale would be of practical value.

The tests chosen from The Merrill Palmer group were:

The placing of 16 cubes
The nest of cubes
The Wallin pegboard, A and B
The repetition of words and word groups
Questions
The buttoning tests
The pyramid tests
Three trials of the Seguin
The action agent test
The little pink tower
The manikin test

Since percentile ratings for each of these tests were given in the preliminary report by Stutsman a comparison of the child's score could be made with the ratings given in the tables.

With the exception of the four language tests (repetition of words and word groups, questions, and action agent) and the manikin, which are scored on basis of amount of work accomplished, scoring was entirely in terms of time. The child was allowed as much time as he desired for each task. It was found that Stutsman's generalization that "a time limit was not necessary because young children seldom work for long periods on tasks which are hopelessly too hard for them" was true in most cases.

Table 1 gives the data of the tests selected from The Merrill Palmer Scale as obtained from 83 cases at the Hopkins' Child Institute. For the individual tests the best, average, and worst scores are given for each age level. Failures are accounted for under the heading of worst score. The average score in each case means the average for those subjects passing the test.

It will be noted that the replacing of 16 cubes in the box, and the two pegboard tests were passed by all subjects

TABLE 1

This table shows the best, the average, and the worst score made by a group of 83 subjects on 18 items, selected from the Merrill-Palmer Scale. Tests 1 to 13 inclusive are scored according to time required; tests 14 to 18 inclusive, are scored *according* to amount of work done.

	AGE GROUPS																	
	24 to 29 months			30 to 35 months			36 to 41 months			42 to 47 months			48 to 53 months			54 *to* 64 months		
	Number of cases in age groups																	
	10 cases			9 cases			13 cases			18 cases			17 cases			16 cases		
	Score is in seconds required																	
	Best	Average	Worst	Best	Average	Worst	Best	Average	Worst	Best	Average	Worst	Best	Average	Worst	Best	Average	Worst
1. Color cubes	43	99.6	170.5	45	91.8	157	42	85.5	295	11	70.5	201	27	54.3	90	35	59.1	132
2. Nest of cubes	9	47.2	120	12	24.7	3F	13	33.1	89	6	23.1	75	7	31.7	130	5	10.4	19
3. Peg board A (Wallin)	18	25.3	35	10	19.7	24	11	21.8	40	10.5	18.3	34	13	17.0	28	10	14.4	23
4. Peg board B (Wallin)	16	34.9	49	12	22.8	31	14	23.8	37	13	19.4	26	10	16.9	31	9	13.4	17
5. Buttons, one	220	341.3	7F	37	97.0	4F	6	27.8	3F	8	23.0	2F	7	20.7	114	39	15.3	4
6. Buttons, two	220	341.3	7F	114	147.3	6F	21	61.0	3F	18	41.5	2F	15	46.6	137	13	28.0	65
7. Buttons, four			10F			9F	64	125.3	3F	37	62.1	6F	27	72.2	2F	31	61.4	183
8. Three cube pyramid	4	29.0	5F	5	8.0	3F	5	12.6	31	4	17.6	75	3	9.0	26	3	5.4	13
9. Six cube pyramid	145	175.0	8F	20	55.5	7F	21	34.1	5F	16	33.0	6F	12	28.2	1F	9	25.7	155
10. Seguin, first	400	334.9	6F	162	240.5	5F	40	89.3	1F	39	113.6	1F	41	64.6	135	32	58.8	147
11. Seguin, best	114	214.6	6F	101	210.5	5F	36	70.8	1F	42	69.3	1F	28	45.3	135	26	40.6	120
12. Seguin, sum	537	295.6	7F	205	337.0	7F	123	280.2	1F	162	270.2	1F	119	181.9	569	99	153.5	193
13. Little pink tower	12	39.7	6F	13	37.2	6F	4	14.4	4F	7	14.1	3F	6	16.9	1F	5	11.1	32
14. Repetition of words	4	4	1F	4	4	4	4	4	4	4	4	1F	4	4	4	4	4	1F
	Score is in *points obtained*																	
15. Repetition of word groups	4	7.1	3F	14	11.6	1F	14	12.5	4	14	13.2	1F	14	13.6	10	14	14	1F
16. Qustions	10	6.5	2F	10	7.8	4	10	9.7	9	10	9.7	1F	10	9.6	7	10	9	1F
17. Action agent	11	6.2	6F	14	8.7	2F	17	17.2	1F	19	14.8	3F	20	15.6	4	20	16.6	1F
18. Manikin			10F			9F	5	2.6	7F	5	3.6	11F	5	3	4F	5	3.4	4F

in each age group. There were three failures for the nest of cubes in the 30 to 35 month group. The buttoning of one and two buttons was consistently failed by some subjects in each group through the 47 month level. These same two tests were passed by all subjects whose ages ranged between 48 months and 64 months. The four button test was failed or refused by all subjects from 24 months to 36 months and was passed by all of the group whose ages ranged from 54 to 64 months.

The three cube pyramid was passed in all cases after 36 months. Successes were scored for each of the 16 subjects in the 54 to 64 month group on the 6 cube pyramid. There were no failures on Seguin after 48 months. Performance within the age levels was inconsistent on the little pink tower. The scores range from four seconds for a perfect performance to failure. The test was passed by all the children in the oldest group. The best score was made by a subject in the 36 to 41 month group.

Failure in the repetition of words and word groups and in answering the questions indicates in most cases refusal to respond in the prescribed manner. The failure, however, of the one subject in the 42 to 47 age level on each of these tests was made by a little Italian boy who spoke only a few English words. He was tested again after three months in The Child Institute and passed the tests.

The range in scores obtained on the manikin are interesting. At each age level after 35 months the range of scores was from five (perfect) to zero (failure).

Because of the small number of cases, we are making no comparisons with Stutsman's percentiles. However, it does seem of some value to show the variations in test scores made by subjects in the same age groups since analysis shows that in many cases refusals and failures are not the result of lack of ability but of emotional conditions or other factors which present themselves in the testing situation.

The problem of the selection of tests applicable to children of the pre-school age requires a survey of many types of performance. Such studies seem to indicate that a large group of tests covering a wide range of situations is desirable for diagnostic purposes. This group of tests, chosen from The Merrill Palmer Scale, offers interesting results. When data obtained from them are combined with data obtained from other motor and language tests, they furnish a valuable source of information in the study of individual children of the pre-school age.

WILLIE MAE C. MOWRER.

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Artificial Illumination for the Preschool Laboratory[1]

RICHARD R. WHIPPLE, M.S.

ARTIFICIAL illumination in three rooms of the preschool laboratory of the Iowa Child Welfare Research Station was improved by relatively simple changes in design. The considerations which controlled the new design are given here in detail.

VISUAL REQUIREMENTS

Illumination design is determined primarily by the type of visual performance required of individuals in the space to be illuminated. The preschool rooms under consideration are used by the three-year-old group from 8:45 A.M. to 11:45 A.M. five days per week and by the four-year-old group from 1:00 P.M. to 4:30 P.M. five days per week. During the winter months, these hours include appreciable periods of very low daylight intensity. The activities of the children include play with various mobile toys and manipulation and construction with various kinds of blocks, easels and paints, clay, scissors, crayons and drawing paper, beads, etc. Dolls and miniature furniture, dishes, brooms, mops, and other household supplies are also available. The activities are such that an adult would perhaps be inclined to dismiss them as not requiring close visual attention or fine perception of detail. But the effect of immaturity must be considered.

The author remembers as one of his early painful experiences the first day he spent in school, after having been kept from school until the age of eight to avoid as far as possible the visual defects of both parents, neither of whom could read a newspaper without glasses. He could recognize all the letters if they were of very large size and could actually read, but the *First Reader* was absolutely baffling in spite of its relatively large type size. Due to lack of experience and practice, a page of this type was nothing but a blur, and it required two days of terrific effort to produce fine enough perception to be able to read. It was not a problem of learning to read but of learning a new visual process, and it was most disconcerting. The ultimate result of this late initiation into "fine" eye work is that the author can still pass the normal vision test with either eye. From this personal experience, two pertinent ideas may be established: First, even such visual work as appeals to an adult as very coarse may and perhaps often does seem exacting to a child when encountered for the first time. It is only necessary to watch a child at play to discover that tremendous concentration and effort are used on relatively simple tasks (fig. 1). Secondly, there is an overwhelming weight of evidence to support the opinion that glare and eye fatigue in the early years are particularly effective in producing permanent damage to the eyes. For these reasons, it seems desirable to supply a preschool laboratory with the best possible illumination at all times.

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[1] The author has received every assistance in this project from Dr. George D. Stoddard, director of the Iowa Child Welfare Research Station, and the members of his staff. Curtis Lighting Inc. coöperated by suggesting the luminaire used. Mr. F. W. Kent, the university photographer, has produced the illustrations. Mrs. R. R. Whipple assisted in the making of illumination surveys and the preparation of the results.

FIG. 1. INTENSE VISUAL EFFORT FOR A SIMPLE TASK

General considerations

There are at least ten general factors to be considered in designing any installation for artificial illumination. They are discussed below with special reference to the preschool application.

Intensity. The intensity of illumination is controlled by the number and size of lamps used, reflection factors of walls and ceiling, type of fixture, etc. Almost any desired intensity may be secured. The range of intensity to which the human eye can adapt itself is very large, ranging from moonlight, which may be about 0.1 foot-candle, up to direct summer sunlight, which is in the neighborhood of 10,000 foot-candles. An attempt to read by moonlight or by direct sunlight will show that the most desirable range of intensity for close eye work is not at either end of this large spread. Present engineering standards of intensity range from three foot-candles for very coarse work through eight to ten foot-candles for schoolrooms, fifteen to twenty-five foot-candles for drafting or sewing, up to three hundred foot-candles for a hospital operating table. A preschool room probably fits in between eight and fifteen foot-candles, depending upon other factors to some extent.

Uniformity. Uniformity is concerned with the distribution of intensity over the floor or working area of a room and is usually expressed by the ratio of maximum to minimum intensity of illumination. Non-uniform illumination causes eye fatigue by requiring constant adaptation to different intensities as the eye wanders around the room. It is a simple muscular fatigue. Also, if the illumination is not fairly uniform, the provision of a given average intensity which sounds adequate will leave certain areas of the room poorly lighted.

Most school lighting codes require that the *ratio of maximum to minimum* intensity shall be less than four. If the value of the ratio is less than two, uniformity is remarkably good. These values seem large, but the eye reacts logarithmically to changes of intensity and a change of two to one is not very apparent.

Diffusion. Diffusion is best illustrated by the contrast between raw sunlight and the diffused skylight when the sun is behind clouds. Well diffused light strikes an object from all directions so that it is not necessary to hold it in any particularly plane to get proper lighting. Any obstruction between the source and object cuts off some light but not all of it, giving soft and luminous shadows as opposed to the sharply defined black shadows resulting from a concentrated source. Good diffusion contributes to "natural" appearance, convenience, and freedom from eyestrain.

Glare. Glare is the greatest damaging factor in artificial illumination due to the small sources of high brilliance. It is defined as any condition in the field of view which produces discomfort because of high brightness. Direct glare from lighting fixtures arises from the use of improper reflectors, from failure to use any reflector, or from mounting the units too low. Reflected glare is the result of using too small inclosing fixtures in connection with glossy surfaces, so that a direct reflection of the bright fixture is seen on the working plane. Glare of both kinds is at its minimum with indirect lighting by which the entire ceiling surface becomes the apparent light source. The source is at maximum height and, due to its extent, is of the lowest possible brightness to produce a given intensity of illumination. The use of large inclosing bowls of dense white glass, mounted high, gives the least glare of all direct lighting systems. Desk and wall surfaces should always have a matte finish. The uninitiated often confuse glare with high intensity. If the illumination of a room seems too bright, it almost always means that there is too much glare rather than that the intensity is too high. Artificial illumination never approaches the daylight of outdoors even on a dull day.

Shadows. Shadows, while of importance in producing proper images of shape, will be satisfactorily controlled without additional effort if the ideas presented under "Diffusion" and "Glare" are followed.

Color quality. The color given by the usual tungsten filament incandescent lamp is fairly easy on human eyes and gives color values of sufficient accuracy except for such things as matching dyed fabrics, professional art work, etc. "Daylight" lamps should be avoided because of a 20 per cent loss in efficiency without any appreciable gain in visual performance. The light of these lamps is still far from daylight color. Indirect lighting systems use the ceiling surface as a reflector and the resulting illumination will be of a color dependent on the ceiling finish. Therefore, a ceiling for indirect lighting should be white, cream, light gray, or a very light tint of green or blue.

Efficiency. The efficiency of artificial illumination should be measured in terms of a certain ability to see without eyestrain for a given cost in dollars per year of total expense. More conventionally, efficiency is expressed as the quantity of light falling on the working plane compared to the quantity of light emitted by the bare lamp. These definitions do not give the same results because it is to be expected that a system which controls the light adequately to give good diffusion and prevent glare will be less efficient than a simple reflector directing all the light downward to the working plane. But the less efficient, on this basis, may be the more desirable. By the conventional definition, indirect lighting is usually about thirty per cent less efficient than direct lighting, and yet it may easily produce the best vision available for a given expense. A lot of light on the floor is not the ultimate purpose of illumination. A modern tendency is toward the use of a great many small lamps. By shifting to indirect fixtures, proper control of large lamps may be provided and the inefficiency of the indirect system is more than compensated by the higher efficiency of the large lamps. One 200 watt lamp emits twice as much light as eight 25 watt lamps. Efficiency is relatively more important than cost of fixtures. A fixture is purchased only once, but its inefficiency exacts tribute on every monthly bill for energy. One of the fixtures purchased recently for this preschool for $13.50 will consume $250 worth of energy in the next ten years. One could afford to double the first cost if it would provide an efficiency 5 per cent higher.

Maintenance. Lighting fixtures, lamps, and all reflecting surfaces need to be carefully cleaned at regular intervals, as efficiency drops rapidly with dust collection. Fixtures which are easily opened and cleaned should be chosen.

Aesthetic suitability. It is possible to make an efficient lighting fixture which has a pleasing appearance, either lighted or unlighted. For the preschool, a simple, neat appearance without much effort at decoration is desirable.

Cost. The subject of cost with respect to efficiency was discussed under "Efficiency." In general, the cost of good lighting is no greater than the cost of poor lighting. The social value of good illumination is tremendous as compared to the cost.

Specific considerations

In the preschool rooms under consideration, the artificial illumination is used a great deal. Daylight is not very good in two of the rooms, due to orientation of the building, location of neighboring structures, and small window area. The laboratory was formerly a residence, and there are relatively few outlets available, so that it is difficult to get proper coverage of the floor area (uniformity). This difficulty is increased by the fact that the ceilings are only nine and two-thirds feet high. These low ceilings make it difficult to avoid glare with any direct lighting system. The artificial lighting will undoubtedly be used more in the future because it is of higher intensity. It is natural to turn the lights on as daylight fails, but if the added artificial light does not seem to add much to the total, the lights are switched off until it gets darker.

Higher intensity lighting will be found to be comparable to daylight more hours of the day and hence will be used more.

THE OLD INSTALLATION

A description of the former installation and photometric measurements made under it are included here to indicate what poor illumination was accepted by an otherwise progressive preschool management. This description will also provide a basis for comparison with the new installation. The improvement made by rather simple and inexpensive changes is astonishing. Floor plans of the rooms are shown in figure 2.

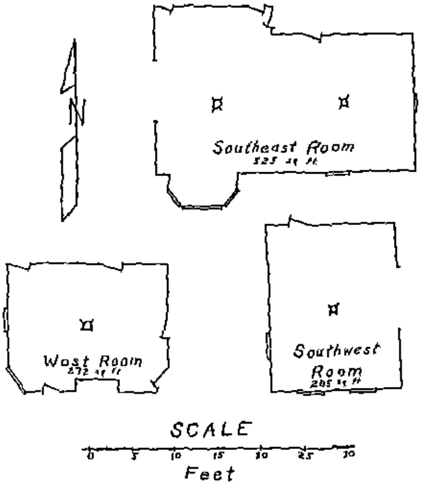

Fig. 2. Floor Plans of the Three Rooms

The west room, as illustrated in figure 3, had a five branch hanging fixture equipped with bare 40 watt frosted lamps. The woodwork in the room was dark, and the appearance was very dingy. The uniformity was poor with a ratio of maximum to minimum illumination of 6.6. The average intensity was 0.8 foot-candle, insufficient for the simplest visual requirements. Direct glare was very bad, as is apparent from the photograph. There were multiple sharp shadows. Bare lamps do not provide satisfactory illumination under any circumstances.

The southeast room, shown in figure 5, had two decorated white glass inclosing bowls, each with a 150 watt lamp. The general appearance of the lighted room was satisfactory, but the uniformity was poor, the ratio of maximum to minimum illumination being 6.8. The average illumination was 1.26 foot-candles, just barely sufficient for adult reading without immediate discomfort. Direct glare was not bad, but an increase of intensity by using larger lamps in the existing fixtures would have raised their brightness to a dangerous value. Shadows were reasonably good.

The southwest room (fig. 7) had one fixture of the same type as the southeast room; this fixture was equipped with a 100 watt lamp. General appearance was satisfactory. The uniformity was the best of any of the rooms (5.35), and the average intensity of 1.94 foot-candles was also the best of the three rooms. The installation was satisfactory from the standpoint of glare and shadows. Due to the expertness of the photographer, figures 3, 4, and 5 appear much better lighted than did the actual rooms.

The new installation

All three of these rooms were changed to totally indirect lighting, using an opaque bowl unit known as The Gem No. 5050 by Curtis Lighting, Inc. The original outlets were used in

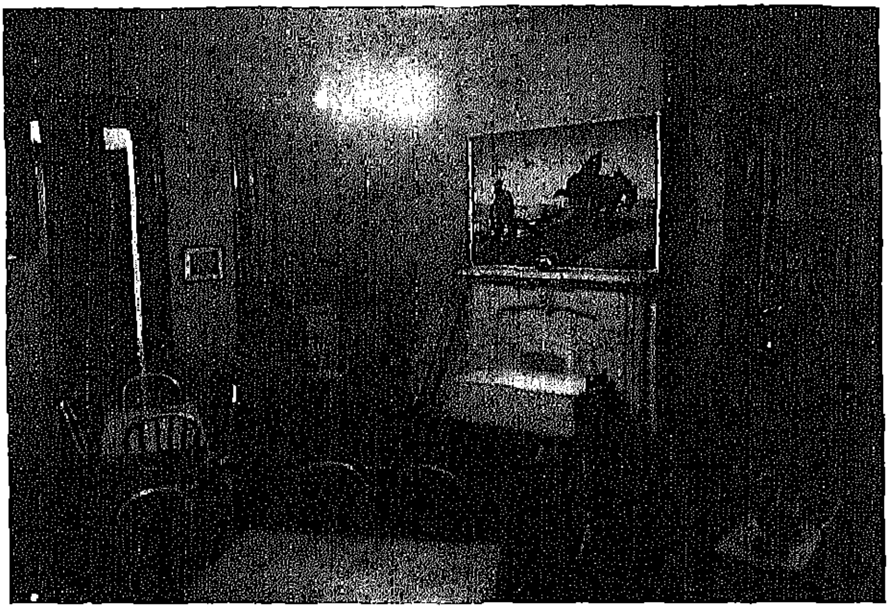

FIG. 3. OLD LIGHTING IN THE WEST ROOM

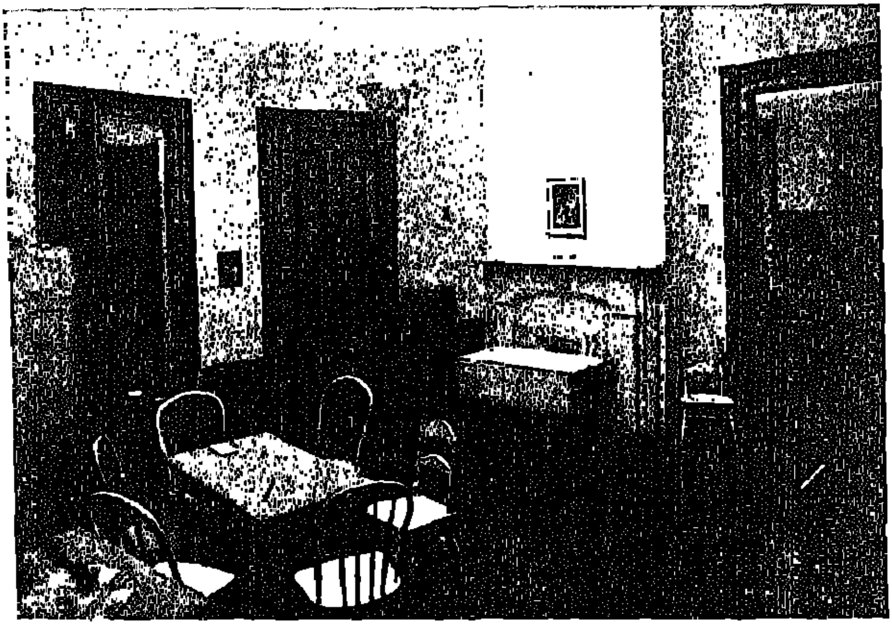

FIG. 4. NEW ILLUMINATION IN THE WEST ROOM

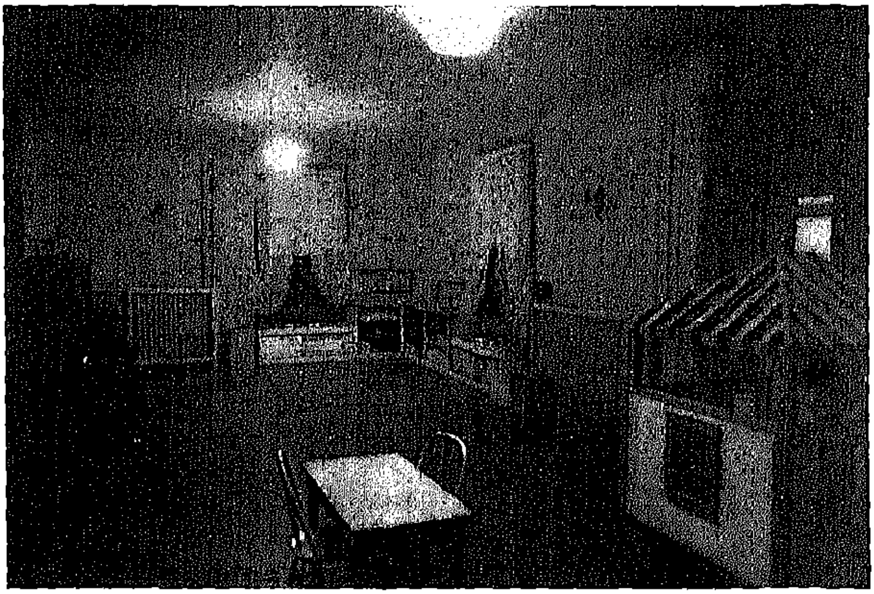

FIG. 5. OLD LIGHTING IN THE SOUTHEAST ROOM

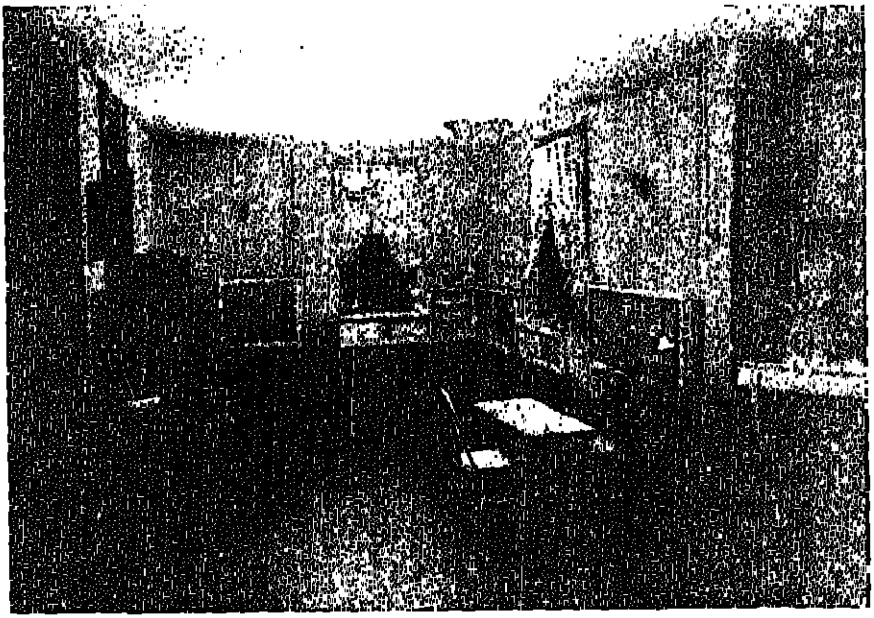

FIG. 6. NEW ILLUMINATION IN THE SOUTHEAST ROOM

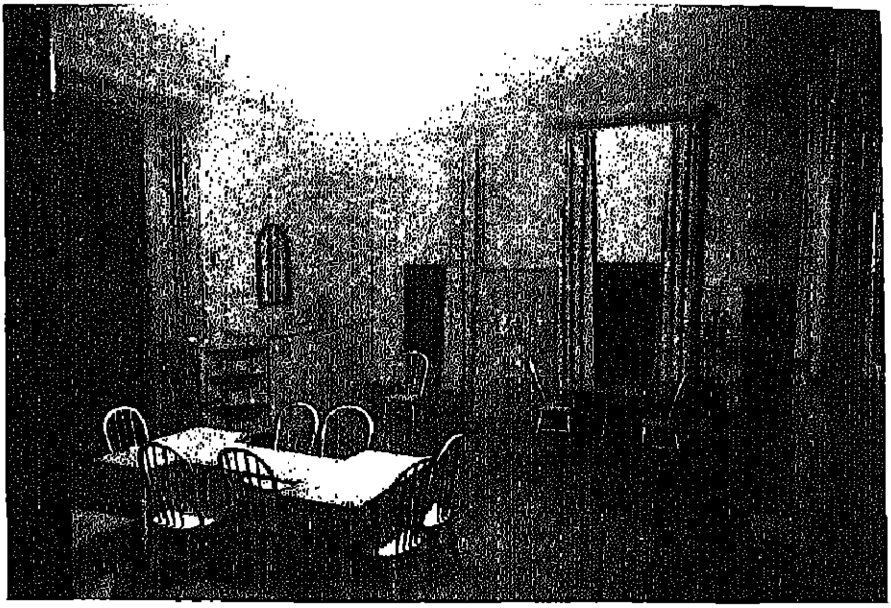

Fig. 7. Old Lighting in the Southwest Room

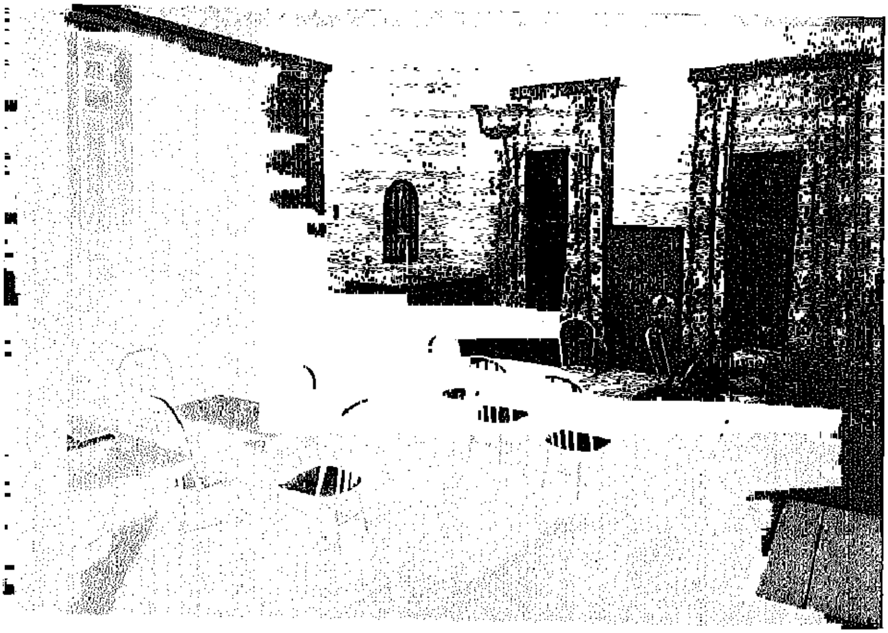

Fig. 8. New Illumination in the Southwest Room

each room, so there was no wiring expense. The fixtures were hung as low as possible, leaving only six feet, two inches of clearance from the floor, in order to cover a large ceiling area to improve uniformity.

The new illumination in the west room is shown in figure 4. The fixture contains a 500 watt lamp. The ratio of maximum to minimum illumination is reduced to 4.4. This figure is scarcely low enough to be desirable, but the effect of poor uniformity is compensated by the high intensities used. The average illumination is 8.3 foot-candles and the minimum in usable parts of the room is 6 foot-candles. It would be impossible to improve the uniformity in this room without repainting the woodwork or using two outlets.

The southeast room, shown in figure 6, was supplied with two 500 watt lamps, which produced an average illumination of 6.5 foot-candles with a uniformity ratio of 3.3. This is very satisfactory.

The southwest room, shown in figure 8, has a 300 watt lamp and the artificial illumination is an average of 5.5 foot-candles with a uniformity ratio of 3.3. The designed intensity of this room is lower than for the others because it has the best daylight and is less used than the others.

It will be noticed that the ratio of maximum to minimum illumination in each case is approximately one-half of the former value. This improvement in uniformity is due entirely to the change from direct to indirect lighting. The average intensity has been increased from threefold to tenfold simply by increasing the ratings of the lamps used. The new intensities do not fit the suggested values of eight to fifteen foot-candles because during the use of these rooms by preschool children there is always an appreciable daylight intensity to swell the total. The room with the poorest daylight has the most artificial light provided, etc. There is no glare of any kind in any of the rooms, and the shadows are soft and luminous. Vertical surfaces are as well illuminated as the horizontal working plane. All intensity measurements quoted were taken by the author with a Weston Illuminometer on a horizontal plane eighteen inches above the floor.

The rooms of the preschool laboratory now have a decided air of cheerfulness, even on a dull winter morning. One has the impression of stepping into sunshine on going indoors! The psychological effect of good lighting is of great importance. There is also a distinct educational value. Both children and visiting parents have an opportunity to see what good illumination looks like, and improvement at home may follow. Illumination of residences is far behind industrial and commercial lighting. Is it too much to hope that good illumination in the schools will produce, in the next generation, adults who will demand proper illumination of homes and work places?

REFERENCES

Interesting material on the subject of illumination for the nontechnical reader will be found in the following publications:

(1) Committee on Residence Lighting of Illuminating Engineering Society: Artificial light and its application in the home. New York: McGraw-Hill, 1932. Pp. viii, 145.

(2) HARRISON, WARD, AND STALEY, K. A.: Fundamentals of illumination. General Electric Co., Nela Park Engineering Dept., Cleveland, Ohio, 1931 (January), Bulletin L.D. 1-A, pp. 60.

(3) HARRISON, WARD, AND WEITZ, C. E.: Illumination design data for industrial and commercial interiors. General Electric Co., Nela Park Engineering Dept., Incandescent Lamp Dept., Cleveland, Ohio, 1930 (January), Bulletin L.D.-6, pp. 36.

The Hurdle Jump As a Developmental And Diagnostic Test of Motor Coördination For Children From Three to Twelve Years of Age

EDWINA A. COWAN AND BERTHA M. PRATT

IN EXAMINING the motor coördination of children twelve years old and under at the Wichita Child Research Laboratory at Friends University, we felt the need of a test for motor coördination which would not involve any eye-hand coördination, which would be a true index of the child's capacity to make adequate motor adjustments to situations confronting him hour after hour in his play and home life, which would be practical for use in routine examinations in the laboratory, and which should lend itself to standardization. In experimenting with different devices to meet this need, we found that a standing jump over an adjustable hurdle met all these requirements most successfully.

The following is an account of work we have done during a period of four years toward standardization of this test and of the clinical results we have obtained with its use.

We make grateful acknowledgment to Mr. L. W. Mayberry, Superintendent of Wichita Public Schools; to the school principals, the school teachers, the students of Friends University and the coöperative mothers who by their interest, encouragement and gracious expenditure of time have made this study possible. Lastly, we make our devoirs to the women of the Wichita Child Research Laboratory Board, through whose unstinted gifts of time and interest the benefit of psychological research and service is given to the children of Wichita.

DESCRIPTION OF APPARATUS

The apparatus used consisted of two hurdle posts and a bamboo stick; each hurdle post was built of an upright piece of wood two by two and fifty-four inches high; brackets on three sides formed the base. The unbracketed surface of each hurdle post faced the other hurdle post as they were placed side by side. Forty-one round metal pegs, a quarter of an inch in diameter and extending an inch and a half from the edge of the two by two were fitted into holes in each post. These holes were located one above the other on a line running along the center of the front side of the hurdle post as it stood with the unsupported side facing the other hurdle post. The center of the lowest peg was three and one-half inches from the floor; the pegs were so spaced that there was an inch and a quarter from center to center of each peg. The hurdle pole consisted of a bamboo stick approximately three quarters of an inch in diameter and four feet long. This was used to extend from a peg on one hurdle post to a corresponding peg on the other hurdle post, forming a complete hurdle adjustable as to height.

Experimental procedure

The child was asked if he liked to jump and the posts and the bamboo stick brought forward and placed in position. They were placed about three feet from each other with the unsupported sides facing each other and all the pegs extending in the same direction. The pole rested on the two lowest pegs. The child was asked to stand about a foot or less from the pole half way between the posts and on the opposite side from the pegs; he was asked to make a standing jump over the pole with both feet at once. The direction of his jump was such that if he hit the pole, it would roll off the pegs and the child would not be tripped. If, in jumping, the child hit the pole or for any other reason failed to make the jump successfully he was given another trial with the pole at the same height. If he failed on the second attempt, he was not asked to jump higher. If he succeeded on the first or second attempt the pole was moved up one peg. Each time the child successfully accomplished the jump on the first or second trial, the pole was moved up one peg until two successive failures to clear the pole occurred at the same height. Sometimes, if we were examining a child who was very timid about jumping, a child badly retarded in motor coördination or a child under three years of age, we placed the pole first upon the floor between the posts and allowed the child to make the slight jump necessary to get over the pole. If the child was successful in making this jump, the pole was then placed on the first peg. If the child did not understand the verbal instructions the experimenter made the jump to show him how. If he failed to keep his feet together in starting and finishing the first jump, he was reminded that he should try to keep both feet together. After this first reminder nothing more was said about the form of the jump. If the children were able to jump at all, they were uniformly interested and eager to see how high they could jump. A standing jump was always insisted upon. They were never allowed to make a running or a stepping approach to the hurdle.

There were two possible variables involved in scoring the jump: one, the height of the jump; the other, the form in which the jump was made. The height of the jump necessary to clear the pole varied according to which of the pegs the pole rested on. The pegs were numbered from one to twenty-three. Peg number one was nearest to the floor. These numbers were listed on the scoring sheet (see table 1) and a check made opposite each number when its corresponding peg was used during the test. The following variations of form in making the jump were possible: the jump might be made with both feet together on leaving the floor and regaining the floor; one or the other foot might be ahead in either of these situations; the landing might be made upright; or the child might fall forward to his knees, or to his hands and knees. More rarely, he might fall backwards. He might attack the jump with confidence or timidity.

TABLE 1

Hurdle

Name............................ Date............................ Age.............
Fear.............. Grade............... Age Level..............

HEIGHT of pole	FEET LEFT FLOOR			FEET REGAINED FLOOR			LANDING MADE			
	Left ahead	Right ahead	Together	Left first	Right first	Together	Upright	Knees	All fours	Backward
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
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25										

Arrangements were made on the scoring sheet (see table 1) for recording by checks in appropriate columns the exact form of each jump made during the test. For the sake of uniformity in handling of quantitative results, we defined a jump made in good form as one made with both feet leaving and regaining the floor together and ending in an upright landing. The presence or absence of fear was not included in the definition, although record was made of timidity, and the fact sometimes used in assisting diagnostic interpretation of individual records.

The highest jump which the child made in good form, as herein defined, was accepted as the limit of the child's achievement. Even though the child cleared the pole when set on a higher peg, if the two feet failed to leave the floor together or to land simultaneously or if the landing was not made upright, this height of jump was discarded in the child's achievement record. Sometimes the acceptable form of the jump lapsed at one height but was regained at a higher jump level. The highest jump made in good form was always accepted, no matter how many preceding jumps had been made in unacceptable form.

The scoring sheet also made provision for recording the child's name and age in months and the date of the test.

We were interested in determining the value of this test as a diagnostic test for children twelve years and under. In standardization, therefore, we used, as subjects, children between the ages of thirty-six months and one hundred fifty-five months. To obtain the records for children between sixty and one hundred fifty-five months we made arrangements with the school authorities whereby we could give the test to children in the kindergarten and elementary buildings. The experimenter was given the use of a small room and the children were sent to her one at a time from the school room.

The records for the children under sixty months of age were obtained by visits to the Children's Home, a local institution for children whose parents are unable to maintain them in their own homes; to the homes of children whose names were obtained from the Cradle Rolls of churches; and to the three day nurseries conducted by The Family Welfare Association and the Junior League of Wichita. Additional records for all ages were obtained by making this test a part of the routine examination given to children who were brought into the Wichita Child Research Laboratory for diagnosis and supervision of training problems. In taking records from the files of the Laboratory for use in standardization, we used only those of children who exhibited no difficulties with motor coordination in extro-laboratory situations and whose training problems did not involve motor coördination. No such basis for elimination was possible in connection with the children used outside of the Laboratory and they, therefore, represent an unselected group. Of a total of five hundred forty children examined, twenty-five were examined in the Laboratory.

The five hundred forty children comprising the experimental group were divided as follows among the age groups:

3 years (36–47 months)	34
4 years (48–59 months)	37
5 years (60–71 months)	40
6 years (72–83 months)	27
7 years (84–95 months)	91
8 years (96–107 months)	44
9 years (108–119 months)	53
10 years (120–131 months)	75
11 years (132–143 months)	97
12 years (144–155 months)	42

In the preliminary studies it was found that the test was not applicable to any children under three years, but that at 36 months a few children could jump at least one notch. Because of this we arbitrarily selected 36 months as the starting point for chronological age groups rather than the more usual 42 months. The original plan was to have 50 children of each age group included in the experimental group. Because twelve years was set as the upper limit of the group, this would have made a total of five hundred. However, using a public school as the source of most of our records, we were not able to find fifty children for each of all the groups and some groups have nearly four times as many as others. This irregularity in numbers apparently does not affect the reliability of the results as a whole, as these results show a high degree of consistency.

TABLE 2

NOTCH JUMPED	AGE (IN YEARS)									
	3	4	5	6	7	8	9	10	11	12
	Number of children in age group									
	34	37	40	27	91	44	53	75	97	42
	per cent	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*
1	68	90	95	96	97	100	100	100	100	100
2	59	90	95	96	97	100	100	100	100	100
3	38	84	92	96	97	100	100	100	100	100
4	32	70	90	93	90	100	98	100	99	100
5	29	51	88	89	90	98	96	100	99	100
6	10	35	83	89	85	93	94	100	99	100
7	6	21	80	78	82	89	94	99	99	100
8			68	67	77	86	94	97	99	100
9			45	52	68	84	92	96	99	100
10			35	44	59	75	85	96	98	100
11			20	41	45	63	81	95	96	100
12			10	29	28	48	77	89	95	100
13			5	11	11	34	66	79	84	100
14				9	4	27	51	68	80	95
15					1	16	34	58	71	90
16					1	14	23	30	56	81
17						5	15	17	41	59
18						5	2	8	31	40
19								6	23	29
20									9	17
21									6	7
22										2
23										2

RESULTS

The first problem set was the establishing of a series of norms. Hypothetically, we assumed the developmental nature of improvement in the ability to make this jump. Therefore we used Dr. Arnold Gesell's (1) technique in establishing developmental schedules for pre-school children as the technique best suited to this problem.

Table 2 presents the numerical figures in terms of cumulative per cent showing the height of jump made by children of the various ages.

Dr. Gesell's system of grading is as follows: 1–19 per cent, A+; 20 per cent–49 per cent, A; 50 per cent–64 per cent, B+; 65 per cent–84 per cent, B; 85 per cent–100 per cent, C.

Applying this system to our figures for height of jump for the chronological ages used, table 3 was developed.

The table is incomplete in the four-year-old group. Preliminary tests were made with very low hurdles having only seven notches, and when the tall hurdles were used in the later tests the work was not repeated with the three- and four-year-olds, as so few of them had jumped even up to the seventh notch. However, in the four-year-old group, eight children did jump seven notches. This is 21 per cent and obtains only an "A" rating. This four-year-old group is the only one in which an "A+" rating was not obtained, but the 21 per cent is very close to such rating.

TABLE 3

NOTCH JUMPED	AGE (IN YEARS)									
	3	4	5	6	7	8	9	10	11	12
1	B									
2	B+	C								
3	A	B	C							
4	A	B	C							
5	A	B+	C							
6	A+	A	B	C						
7	A+	A	B	B	C					
8			B	B	B	C				
9			A	B+	B	B	C			
10			A	A	B	B	C			
11			A	A	B+	B+	B	C	C	
12			A+	A	A	A	B	C	C	
13			A+	A+	A	A	B	B	B	C
14				A+	A+	A	B+	B	B	C
15					A+	A+	A	B+	B	C
16					A+	A+	A	A	B+	B
17					A+	A+	A+	A+	A	B+
18						A+	A+	A+	A	A
19								A+	A	A
20									A+	A+
21									A+	A+
22										A+
23										A+

This table may be read as follows: a five-year-old child who makes a jump of seven notches has a grade of "B," which means that from 65 per cent to 84 per cent of the five-year-old children jumped as well as he did. If he had jumped 13 notches, his grade would have been "A+," which would mean that only 19 per cent or less of the five-year-old children jumped that high. But an eleven-year-old child who jumps thirteen notches gets a grade of "B." A child who jumps as well as 85 per cent of the children of his age (appearing on the table as the last "C" in each vertical column) may be regarded as having satisfactory motor coördination. A child who jumps higher or lower than this satisfactory jump may be compared either with children his own age or with children older or younger than he. For instance, a child of five who jumps twelve notches has a grade of "A+" within his own age group, or he is advanced developmentally to a level satisfactory for an eleven-year-old. On the other hand, a child of eleven who jumps seven notches is definitely retarded, since all eleven-year-olds should be able to jump at least eleven notches, and his score of seven must be interpreted in terms of a satisfactory jump for a seven-year-old. This system gives flexibility and accuracy to the interpretation of a jump.

TABLE 4

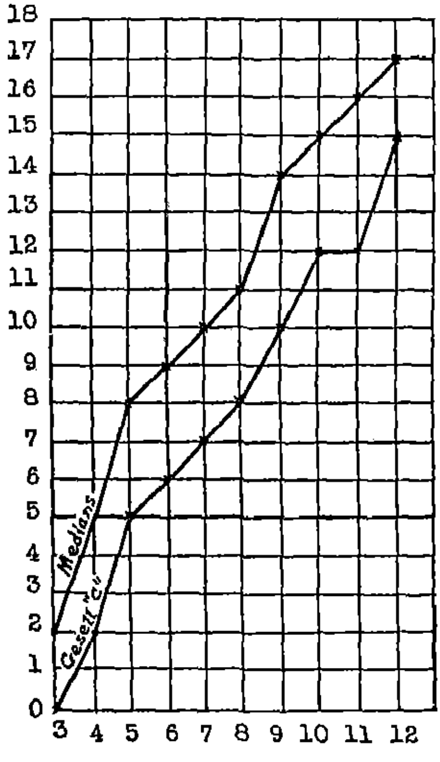
AGE	MEDIAN JUMP	GESELL "C"
3	2	0
4	5	2
5	8	5
6	9	6
7	10	7
8	11	8
9	14	10
10	15	12
11	16	12
12	17	15

For purposes of comparison with these norms the median jump for each age was worked out. The following table gives the median jump and the jump at which the grade of "C" was assigned by the Gesell technique, for each age.

Throwing the figures of table 4 into graph form, the curves for medians and for the Gesell "C" show very similar characteristics. Whether measured by the median or by the Gesell "C," the height of the jump increases with age in the same degree. See table 5.

There is a consistency in these results which suggests the validity of the jump as a developmental index of motor coördination. The older the child is the higher he jumps. There are, however, obviously other factors which may enter. The older the child is, the taller he is and the heavier. Should the efficiency of his ability to jump be measured in terms of his age or in terms of his height or weight or in terms of the relation of his height and weight

TABLE 5



to his age? To further validate the developmental character of the jump, the correlation technique was applied to all results for children over five years. There was no way to obtain the heights and weights of the pre-school children as their records were obtained through so many sources and over such a long period of time.

If weight is the determining factor for the height of jump, then there should be a high correlation within each age group between weight and the jump, as age is held constant. The results, using the Pearson product-moment formula, were as follows:

5 years	$r = .27 \pm .10$
6 years	$r = .11 \pm .13$
7 years	$r = .00 \pm .07$
8 years	$r = .20 \pm .10$
9 years	$r = .22 \pm .09$
10 years	$r = .16 \pm .08$
11 years	$r = .07 \pm .07$
12 years	$r = .00 \pm .11$

The only correlations high enough to be regarded as possibly significant are in the five, eight and nine year groups. In view of the fact that the correlations in all the other groups are entirely insignificant we feel justified in believing the weight of the children not to be a determining factor for the height of jump.

In correlating the jump and height with each other within the age groups, we find the following:

5 years	$r = .30 \pm .08$
6 years	$r = .31 \pm .12$
7 years	$r = .16 \pm .07$
8 years	$r = .00 \pm .10$
9 years	$r = .35 \pm .08$
10 years	$r = .13 \pm .07$
11 years	$r = .24 \pm .07$
12 years	$r = .30 \pm .09$

Here we find higher coefficients than in the correlation of the jump and weight, but they are not high enough for it to be maintained that height alone can be the determining factor for the height of jump. It may be that if a child is tall for his age he will make a slightly better jump than a child of the same age who is short.

Although weight and height alone apparently have little significance for the height of jump, it is possible that their relation to each other and to age might have some effect on the child's ability to jump. For instance, does a short, fat child of eight jump more poorly than a tall, slim child of eight? To answer this question statistically, the relation between height and weight must be expressed in terms comparable for all ages. Our first step toward this expression was to obtain from a pediatrician a standard chart of heights and weights for children of all ages. From this chart an index which we chose to call the "corporocity index" (C. I.), or the expression of the relation of height to weight, was calculated for each age and for boys and girls separately by dividing weight by height. Next, the "C. I." was calculated for each child. This done, the deviation from the normal "C. I." for each child's age, and the deviation from the median jump for his age was found. If these two deviations were to show a high correlation with each other within the age groups, then it might be assumed that this relation, as expressed here, could be significant in determining height of jump. Using the Pearson product-moment formula, except in the case of the six-year-old group, where the Spearman rank difference formula was used, we have the following results:

5 years.............. $r = -.008$
6 years.............. $r = .22$*
7 years.............. $r = .08$
8 years.............. $r = .05$
9 years.............. $r = .01$
10 years.............. $r = -.03$
11 years.............. $r = .05$
12 years.............. $r = .04$

* Spearman rank difference formula.

All of these results are so insignificant that we may state with little hesitancy that the relation of height to weight has no significance in determining the height of jump.

As a final check, since there are four variables involved, the technique of partial correlation was applied to the entire group, the principal objective being to find the correlation between the jump and age with height and weight ruled out. The raw correlation between these two was found to be .77; with the factors of height and weight ruled out, .57. Weight alone had nothing to do with the height of jump. However, the figures indicated that a possible slight significance might attach to height of the child. This is probably enough to account for the lowering of the coefficient between jump and age. Another possible reason for the lowering of this coefficient may be sought in the figures for raw correlation of jump with height and weight. The raw correlation between jump and height was $r = .67$, and that between jump and weight was $r = .61$. Although these correlations are made for the entire group regardless of age, they are higher than one would expect and on that account may explain somewhat the lowering of the coefficient between jump and age. This does not make less accurate the statement that the jump, standardized in terms of chronological age, may be used as a definite, quantitative measure of motor coördination.

Clinical use of the test

In the course of developing experimental technique for this test, and for a period since the standardized norms have been available, we have used the test in connection with clinical work in the Wichita Child Research Laboratory and have found it of diagnostic value in three ways:

First, it makes possible a quantitative grading of defective motor coördination in cases of birth injury, infantile paralysis, and other organic defects of the nervous system. The fact is clearly observable that children who have suffered birth injury are retarded in their motor coördination, and are crippled in their attempts to handle their bodies as other children do. No matter how obvious this crippling may be, it is often desirable to measure it in quantitative terms which offer a basis for comparison between individuals and between performances of the same individual at different times.

Second, in a number of instances the test has uncovered for us slight retardations in motor coördination which were affecting the personality and social adjustments of children. The cause of the difficulty had not been clear to the parents because the children's ability to walk and get about had not been noticeably affected. In such cases parents uniformly commented as follows: "We knew she did not run and play active games with the other children; but we thought it was because she did not like to, was lazy, or did not want to play with other children in this active way." One child had been severely reprimanded in kindergarten because she did not join in the skipping games. The history of her year in kindergarten was described as completely lacking in cooperative effort and social adjustment to the group. The child, who was seven years old at the time, showed marked personality and social difficulties due to her inability to participate in the group play of other children, and was already embarked upon a career of school failure. The test showed that the child was unable to skip or play the running, active games of other children, although she did not even show awkwardness in walking. Other parents reported that their children had always been awkward and stumbled a great deal. They had attributed this to carelessness and inattention because the child seemed able to get about in a satisfactory manner. These children were inevitably shy and timid, lacking the self-confidence engendered by the achievement of adequately controlled motion on the part of a child whose coördination level is normal. If a child cannot depend upon his two feet to carry him safely and comfortably across a room and up and down steps, and to maintain a steady balance in the face of slight spacial discrepancies, surely this child cannot be expected to develop any genuine self-confidence at a very rapid rate. In some cases acute personality problems of adolescents could be traced to an ever-increasing sense of insecurity due to failure of the initial source of self-confidence, which had been denied them because of retarded motor coördination. In our experiments, children with marked congenital visual defects invariably showed retarded motor coördination and equally marked insecurity of personality.

Third, the test offers a quantitative measure of progress during a motor reëducation program. The motor reëducation technique used in the Wichita Child Research Laboratory is not that which is known as muscle-training in the orthopedic centers. The training differs from muscle-trianing in that it does not attempt to develop a compensatory use of the muscles themselves. The hypothesis underlying our program assumes that in cases where coördinations have failed to appear, which usually do appear as part of the organism's normal maturation process, the adaptive chain of muscular contractions and kinesthesis which constitutes such motor coördinations can in many cases be set up as a *learned activity*.

If this assumption is correct, any process by which the desired coördination can be artificially and correctly produced should ultimately result in the acquisition of the coördination as a learned activity. Our motor education technique has consisted of attempts to produce the acquisition of these learned coördinations in a series which should as nearly as possible approximate the normal developmental series, beginning with the earliest type of grasping motion in the case of the hands, and rhythmic rotation of the feet and knees in case of the legs.

Because we have hoped to produce

a chain of muscular contractions which would be automatized with kinesthesis as the only sensory stimulus, we have blind-folded the children during the periods of artificially produced coördination, except in the case of infants of less than twelve months of age. In the case of the infants we felt that the visual environment was not yet operative as an important source of sensory cues for muscular contractions.

Obviously the best form and order in which to present the artificially produced coördinations is still a problem of research. Available information as to the order of appearance of different maturation levels of the same muscular activity and analyses of complex activities into their component maturation elements are lacking in completeness. In formulating a program we added to the facts at our command continually by means of observations and analyses of observable progress made by children undergoing motor reëducation. These children were constantly under the care of orthopedic specialists and our observations of progress were always carefully checked with their reports. Through this process of feeling our way along the maturation path we arrived at a series of training exercises which we feel roughly approximates successive levels of complexity in motor coördination as achieved by children who make these adjustments under normal circumstances. Because of the importance we attach to the developmental phase of the reëducation process there is very little variation with reference to individual diagnosis in the programs carried on. Each child is started at the beginning of the program no matter what the degree of disability, the only variation being between cases whose disability is general and those for whom it is specifically confined to hand or foot coördination. The following paragraphs describe this motor reëducation program as it has been developed to date:

With the child lying on his back on the floor, we place his hands in normal grasping posture on a slender pole. The trainer insures this grasping posture by holding his own hands over those of the child. The trainer then lifts the child up and down so that the weight is supported by the hands which are artificially forced to maintain a supporting grasp. As soon as progress permits, this exercise is followed by games such as tug of war, chinning, etc., with a soft, strong rope. Next in the series comes the dropping of a small ball and a one inch wooden cube from one hand into the other. Increased facility in this type of handling objects is followed by the working out of block patterns through touch and the lifting of blocks into pattern positions previously ascertained by touch from a model. Blindfold handling and identification of variously shaped and textured objects is encouraged when the child is old enough. The winding and unwinding of a string around a spike fastened in a block of wood is usually introduced at about this point in the training program. The string is wound clock-wise and anti-clock-wise with each hand. This has been found especially helpful in facilitating the coördinations used in hand-writing by older children. From this point on the program for hand coördination becomes one of individual adaptation to the age, needs, and progress of the child.

The foot coördination for very young babies is started by laying the infant on his back, placing a hand flat against the sole of each foot, holding the ankles in place with the fingers and rhythmically rotating the feet in a pedalling motion. In the case of children who are able to stand or walk, the training is begun by placing them in front of a flight of steps, blindfolding them, and letting them step up one step, turn around, and step down. The blindfold is then removed. When the child has achieved facility in this, another step is added and care is taken that the motion involving the two steps shall be a normal alternation of the feet. This is done even if it involves external support of the child and placement of his feet on the steps by the trainer. Steps are gradually added one at a time. When normal progress up and down steps is possible without support, the child is equipped with a bicycle held in a training frame so that it is perfectly steady. The training frame is one which permits the pedals and rear wheel to revolve, while the bicycle remains stationary. The bicycle is carefully fitted to the child in such a way that when the pedal is at its lowest point of revolution, the child's foot rests horizontally on the pedal and the leg is straight from hip to ankle. The child is placed upon the bicycle and then blindfolded. If the child is unable to revolve the pedals, they are revolved for him while his feet are held upon them. After four or five revolutions the blindfold is removed and the child is lifted off. If the child can make the pedals revolve, he is allowed to do so for five or six revolutions and then the blindfold removed and the child taken off the bicycle. As the child becomes more accustomed to the pedalling motion, he is allowed to pedal for a longer period of time, but never for more than five minutes at a time.

After some measure of progress has been made with stair-climbing and pedalling and the child has achieved the rhythmic pedalling or stepping motion, he is taught to stand on one foot and move the other in a vertical, circular motion similar to the pawing of a horse. Following this he is taught to skip and do various kinds of rhythmic marching and stepping motions to music.

The entire training program for both hand and foot coördination is carried out with the child blindfolded whenever he is going through any of these activities. Before the training program is embarked upon, the child is accustomed to blindfolding by games and very short periods of having his eyes closed or covered with his hands or the putting on and immediate removal of a bandage. Candy or sections of orange are used to condition the child to the blindfolding with a liking response. No training activity is undertaken until the child is perfectly comfortable and happy wearing a blindfold bandage. Great care is also maintained to be sure that the child does not fall or have any unpleasant or frightening physical experience during any of these activities. The program is never allowed to become a disciplinary issue. The whole activity is associated with pleasure and assurance in the child's mind.

Nothing that is done in the way of

TABLE 6

Boys' records in capital letters; girls' records in small letters

NOTCH JUMPED	AGE (IN YEARS) 3		4		5		6		7		8		9		10		11		12	
	16 boys	18 girls	17 boys	20 girls	20 boys	20 girls	13 boys	14 girls	49 boys	42 girls	20 boys	24 girls	24 boys	31 girls	27 boys	48 girls	50 boys	46 girls	22 boys	20 girls
1	B+	b	B	c	C															
2	B+	b+	B	c	C															
3	B+	a	B	b	C	c	C													
4	B+	a	B+	b	C	c	B		C											
5	A	a	A	a	C	c	B		C											
6	A	a	A	a	B	c	B	c	C	c										
7	A+	a+	A	a	B	b	B	b	C	b										
8					B	b	B+	b+	C	b		c								
9					A	a	A	b+	B	b	C	b		c						
10					A	a	A	a	B	b	B	b	C	b	C					
11					A	a	A	a	B+	b+	B	b+	B	b	C	c				
12					A+	a+	A	a	B+	a	B+	a	B	b	C	b		c		
13					A+		A+	a+	A	a+	A	a	B	b	C	b		b		
14							A+	a+	A+	a+	A	a	B+	b+	B	b+	C	b		
15									A+	a+	A+	a	A	a	B	a	B	b+	C	c
16										a+	A+	a+	A	a	A	a	B	a	C	b
17										a+		a+	A	a+	A	a+	B+	a	B	a
18												a+	A+	a+	A+	a+	A	a+	B+	a
19															A+	a+	A	a+	A	a+
20																	A+	a+	A	a+
21																	A+	a+	A+	a+
22																			A+	
23																			A+	

exercise is planned or intended to strengthen any muscle or group of muscles. The objective of everything done is the acquisition of adaptive motor coördinations as learned activities. For that reason the learning technique is strictly adhered to. The exercise periods are arranged to give frequent, brief learning periods without any prolonged practice periods. The children are not allowed to repeat any given exercise more than twice in any practice period and the pedalling exercise is held rigidly to a period not longer than five minutes. The different exercises may be combined in one practice group period. Whenever the daily program of the child permits, he is given one practice period in the morning as soon as he gets out of bed, another the last thing at night before he gets into bed, one in the middle of the day, one in the middle of the forenoon and one in the middle of the afternoon. New exercises are added to the practice group when justified by the child's progress.

It will be observed that in this motor reëducation program as outlined there is no part which involves direct practice in jumping, with the exception of skipping, which is introduced toward the last of the program. We have used the hurdle jump test as a quantitative measure of progress in connection with such training programs, and have found the progress of the child from one age norm to another reliably indicative of the general progress of the child's ability to make adaptive motor coördinations, as reported by the mother and as observed in visits to the laboratory. For example, the fact that a child for the first time is able to make a jump in good form over the pole at the first notch will coincide with the statement on the part of the mother that she has noticed in the child's play and routine activity at home much less stumbling and much greater self-assurance.

The motor coördinations acquired in the course of training programs as outlined are indicated as true learned activities by the fact that they show a tendency to lapse or be forgotten in some degree after the training program is discontinued even though the program has been maintained until adequate adaptive coördinations have been successfully acquired. The hurdle jump test reflects this forgetting process with quantitative accuracy and also reflects the rapid restoration of efficiency during a renewal period of the training program. We have not had any cases under observation long enough yet to know whether these acquired motor coördinations can eventually be well enough established to justify permanent discontinuance of training periods. We use the hurdle test to guide us in regulating the periodic resumption and the duration of renewed training periods.

Sex differences. Table 6 shows a comparison of performances of boys and girls in the hurdle jump test. The records for boys are indicated by capital letters, and the records for girls are indicated by small letters. See table 6.

A study of this table will show that there is very little difference in performance between girls and boys of the same age. What difference there is seems to be consistently in favor of the girls up to the age of seven years.

Starting with seven-year-olds, the boys have a slight advantage through the age of twelve.

However, we do not feel that we had sufficient numbers in these different age groups to have established definitely even this small sex difference. In view of the slight amount of difference and of the small number of subjects in some of the groups when divided according to sex, we do not feel justified in advising the use of separate developmental tables for boys and for girls.

SUMMARY

(1) The results of hurdle jumping experiments with children aged three to twelve years inclusive can be graded progressively in chronological age groups according to Dr. Gesell's system of developmental grading.

(2) The median jump for the age groups increases with chronological age.

(3) The curves for the median jumps and the Gesell C are similar.

(4) Weight is not a factor in determining the height of the jump.

(5) While height of stature may be a factor in determining height of jump, it is so slight as to be negligible compared with age.

(6) The relation of height to weight is not a factor in determining height of jump.

(7) Chronological age is a definite factor in determining height of jump.

(8) The form and height of a standing hurdle jump may be measured with sufficient exactitude to provide a quantitative test of gross motor coördination correlated closely with chronological age and applicable to children of ages three to twelve years inclusive.

(9) The statistical findings and the configuration of the results treated according to Dr. Gesell's system of grading indicate that maturation is a determining factor influencing the height of jump and that the test as used is a true developmental test of motor coördination.

(10) The test is clinically of diagnostic value in affording a quantitative measure of retardation of motor coördination; in uncovering minor retardations of motor coördination; and as a quantitative measure of progress during programs of motor reëducation.

(11) There is some indication of slight differences between the sexes in favor of the girls below the age of seven, and in favor of the boys of seven years and above. The evidence on this point is inconclusive.

REFERENCE

(1) Gesell, Arnold: The mental growth of the pre-school child. New York, Macmillan, 1925.

A Comparison of the Flicker Thresholds In Children and Adults

GEORGE W. HARTMANN[1]

THIS study originated in an attempt to test a suggestion of Koffka's (1) that if the hypothesis of the generally high fatigability of the motor nervous systems of young organisms be correct, then presumably on the sensory side the threshold of fusion for rotating discs should be lower for children than for adults. Koffka considers it probable that the resulting greater susceptibility to visual fatigue should lead to the more rapid extinction of flicker in youngsters, since they would be unable to follow the last faint traces of internal differentiation which precede the appearance of a uniform and homogeneous field. Since the problem lends itself readily to a straightforward experimental check, the following simple laboratory situation was arranged.

The apparatus consisted of a D. C. motor with a slide-wire resistance for regulating the speed. An engineering tachometer was coupled to the shaft of the motor and permitted reading directly the number of revolutions made per minute (R. P. M.) at any given instant. All extraneous illumination was excluded from the room, the only light coming from a 100 watt Mazda blue "daylight" lamp suspended from the ceiling but directed upon the color mixer. Only two pairs of cardboard discs were mounted upon the rotator; one black-and-white combination (180° of each) and the other blue-and-yellow, also in equal proportions. Laboratory experience had seemed to indicate that these pairs yielded the smoothest and most satisfactory fusion; at any rate, the phenomena in question could be most readily followed by the subjects when these sets were employed.

In the first group of trials, the records of a dozen normal children were compared with those of adult "controls." Only persons with 20–20 vision who passed a color-blindness test were used. The confidence of the children was gained by a timely distribution of candy and by encouraging them to inspect some of the curios of a psychological laboratory. The nature of the task was carefully and patiently explained to the youngsters; two subjects were eliminated after the preliminary demonstration series because of evident suggestibility and unreliability. All observations took place at a distance of four feet from the rotator. The subjects were asked to watch the flicker at the edge of the disc and to look directly at that area. Although few persons normally take advantage of the higher sensitivity of the peripheral retina, precautions were taken against this possibility by adjusting the observer's chair so that his eyes were in a straight line with the mixer.

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[1] The writer is indebted to his graduate students, Messrs. Swanson and Gettig, for assistance in securing subjects and personal help during the testing sessions.

TABLE 1

Comparison of the thresholds of fusion for young children and adults in terms of revolutions per minute

OBSERVERS	SEX	AGE	180° BLACK + 180° WHITE	180° BLUE + 180° YELLOW
		Children		
A	Female	7	2,700	2,880
B	Female	11	2,350	2,260
C	Female	8	3,370	2,650
D	Female	9	2,930	3,120
E	Female	10	3,760	3,440
F	Male	8	3,320	2,880
G	Male	8	3,370	2,950
H	Male	8	2,440	2,675
I	Male	7	2,960	3,110
J	Male	6	3,760	2,722
K	Male	9	3,200	3,075
Means			3,105	2,887
A.D.'s			(394.54)	(220.91)
		Adults		
L	Male	22	3,110	.....
M	Male	20	2,760	.....
N	Male	20	3,200	.....
O	Male	19	2,900	2,680
P	Male	19	2,950	2,650
Q	Male	18	2,700	3,110
R	Male	18	2,900	2,610
S	Male	19	2,700	2,555
T	Male	25	2,700	.....
U	Male	21	3,000	2,810
V	Male	25	3,200	2,515
W	Male	24	2,940	2,740
Means			2,979	2,709
A.D.'s			(108.83)	(133.50)
Difference in favor of children			126	178

The extinction limens were determined in conventional psychophysical fashion, i.e., by taking the mean of three ascending readings and three descending ones. If anyone of the readings deviated markedly from the trend established by the remaining values, it was thrown out and an extra record made. In all instances, the black-white determinations preceded the blue-yellow ones. Table 1 shows the results thus secured.

TABLE 2

Comparison of the thresholds of fusion for younger and older males in terms of revolutions per minute

OBSERVERS	AGE	180° BLACK + 180° WHITE	180° BLUE + 180° YELLOW
Children			
I	7	2,892	2,760
II	7	3,265	3,320
III	6	2,782	2,645
IV	8	2,982	2,832
V	6	3,480	3,345
VI	6	2,978	2,840
VII	10	2,665	2,430
VIII	8	3,686	3,114
IX	9	3,110	2,670
X	8	2,850	3,076
Means.............		3,069	2,903
A.D.'s.............		(253.00)	(248.40)
Adults			
XI	21	3,140	3,110
XII	25	2,985	2,740
XIII	22	3,070	3,086
XIV	20	3,057	3,674
XV	19	2,668	2,566
XVI	22	3,282	3,002
XVII	20	3,464	3,110
XVIII	23	2,696	2,562
XIX	25	3,250	3,134
XX	23	2,842	2,930
Means.............		3,045	2,891
A.D.'s.............		(198.20)	(205.00)
Differences in favor of children ..		24	12

TABLE 3

Comparison of the thresholds of fusion for younger and older females in terms of revolutions per minute

OBSERVERS	AGE	180° BLACK + 180° WHITE	180° BLUE + 180° YELLOW
Children			
I	8	2,588	2,538
II	7	2,562	2,545
III	7	2,507	2,448
IV	6	2,553	2,674
V	7	2,571	2,543
VI	7	2,541	2,552
VII	7	2,538	2,517
VIII	7	2,526	2,547
IX	7	2,755	2,671
X	6	2,840	2,752
Means.............		2,598	2,578
A.D.'s.............		(81.30)	(71.90)
Adults			
XI	22	2,533	2,516
XII	21	2,599	2,569
XIII	25	2,537	2,449
XIV	23	2,635	2,522
XV	19	2,633	2,526
XVI	24	2,578	2,526
XVII	23	2,581	2,528
XVIII	21	2,619	2,627
XIX	22	2,559	2,581
XX	22	2,627	2,527
Means.............		2,590	2,540
A.D.'s.............		(32.50)	(34.30)
Difference in favor of children ..		8	38

From these figures it is apparent that the adult limens are definitely lower than the children's thresholds. This means that the presence of flicker can be detected by the youngster at speed levels where it has ceased to exist for the adult. The "error of variable standard" seemed at first blush to be responsible for these differences, since one could argue that the children may have waited until the flicker was definitely gone (in the case of the *ascending method*) before reporting extinction. The slower reaction-time of the youngsters would thus produce the effect of a higher mean threshold. However, this tendency (if real) would also operate with the descending procedure and serve to produce lower readings, thus cancelling the former effect. Consequently, this explanation may be rejected.

It may be argued that these children, whose average age was about eight years, are actually adults from the standpoint of sensory functioning, and that a fair test of Koffka's hypothesis would require the use of younger subjects. Unfortunately, this proved to be an impracticable suggestion, for an attempt to use a few bright nursery-school children collapsed entirely because of their high distractibility and the excessive irregularity of their "judgments." A child must evidently be of at least school age before he can be of service in this type of experimentation.

The heterogeneity of the child group with respect to sex raises a more legitimate difficulty. The five girls yield a mean black-white limen of 3022 R.P.M.; the corresponding figure for blue-yellow is 2870. For the six boys the black-white average is 3175 and the blue-yellow 2902—in both instances, the boys' means exceed the girls' by about the same amount that children's averages combined rise above those of the adults. This suggested the necessity for keeping the subjects constant in regard to sex. In the next series therefore, ten other boys with a mean age of 7½ were compared with a new set of ten male undergraduates. These results appear in *table* 2. The precision of these values is somewhat greater than those given above since five ascending and five descending determinations were now made instead of the three previously required.

On this occasion, the differences in the extinction thresholds for the two groups are considerably less pronounced, but the children maintain the higher averages with both stimulus-pairs. Certainly no support for Koffka's view can be found in these two tables—in fact, the direct opposite appears to be a more plausible position. A further check was made involving ten little girls and ten college women, the adults being tested first. The children were second grade school children of more than average brightness. The discs used in this series were of somewhat different shade than that previously employed, but the comparison between the adults and the youngsters is not affected thereby. Table 3 presents these findings.

Here again complete confirmation is given to the results of the first two tables. The extinction thresholds of the older and younger subjects are essentially identical, with but a small margin in favor of the children on both sets of discs.

These figures point to but one conclusion: The measured behavior of children of primary school age and young adults reveals substantially the same performance, with respect to the rates of revolution at which flicker ceases to be detected. Evidently the fundamental mechanisms involved in this type of visual discrimination achieve maturity relatively early in life.

SUMMARY

Thirty young school children and thirty adults were measured in standard psychophysical fashion with respect to the rotary velocity required to extinguish flicker effects produced by (1) black and white discs and (2) yellow and blue discs, combined in equal proportions. No significant differences between the thresholds for the two age groups were found.

REFERENCE

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Children's Drawings: An Experimental Study of Perception

E. B. HURLOCK AND J. L. THOMSON[1]

DRAWING, as a means of expressing what one perceives, is commonly used in the free, spontaneous drawings of children. The purpose of the experiment to be reported below was to discover what young children perceive with sufficient consciousness to portray at a later time, when the object is not present, in their spontaneous drawings of eight specified objects.

Much theoretical and experimental work has been done in an attempt to study children's drawings. Those studies which have any relationship to the study reported in this paper are summarized below. In summarizing the studies, it seemed best to use the historical sequence method, beginning with the work of Barnes (4) in 1893, and coming down to the present time.

HISTORICAL SURVEY

The drawings of 6,393 children, ranging in age from six to sixteen years, in their free illustration of the poem, "Johnny Look in the Air," were recorded and analyzed by Barnes (4). From the data obtained, Barnes made many deductions, the most important of which are as follows:

1. For the young child, drawing is a language, a means of expressing ideas, in which symbols and conventional forms are used.
2. The courage to express their ideas through pictures increases to the age of 13 or 14 years.
3. Children like to draw large, distinct figures, expressed with few lines.
4. Children are interested in heads. Up to nine years of age, they draw full faces, then profiles.
5. For decorative effects, they use colors; for drawing pictures, they prefer black and white.
6. Typically, the child's drawing is full of movement.
7. There is little difference between the drawings of boys and girls.

One year later, in 1894, Herrick (16) made a similar study of the drawings of 451 children, illustrating the same poem as that used by Barnes (4). He found that boys and girls followed the same lines of interest and development, although boys expressed themselves a trifle more fully. The tendency to draw profiles instead of full face occurred in 9.5 per cent of the drawings of the 5–6-year level; in 55.5 per cent of the 10-year level; and in 68.7 per cent of the 14-year level.

"What children draw to please themselves" was studied by Maitland (22) in the case of children ranging in age from five to seventeen years. Up to the age of ten, it was found that attempts to draw the human form predominated; objects of still life showed a predominance at all ages; houses, animals and plants were drawn less frequently in the older than in the younger age levels; and, interest in geometric design and ornament increased with age.

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[1] The senior author suggested and outlined the problem reported in this paper, supervised its progress and prepared the manuscript for publication; the junior author carried out the experiment and presented it as a Master's Essay at Columbia University.

As a means of determining the best method of teaching drawing, Lukens (21) made a study of the drawings of children from 2 to 16 years of age. Three-quarters of all the drawings studied were of human figures. The best drawings showed a tendency to draw long, firm, continuous lines.

Biographical records and observational notes of individual children's drawings were made by Millicent Shinn, Katherine W. Slack, Eleanor G. Sharp and Lulu M. Chapman. These were edited by Brown (6) in 1897 in the University of California Studies, and covered the age period of eighteen months to six years. Slack noted that after the age of 5 years 6 months, "Ruth" began to draw houses, churches and boats, and that she took more pleasure in color than in form. According to Sharp, "Bayard" began to draw horses at 2 years of age. At 3, he copied objects and found subjects more interesting than color. "Carroll," Chapman reported, always showed an interest in color, and any new feature included in his drawings was exaggerated.

In the study of her niece, Shinn observed the following stages of development in drawing: 1. Drawing as imitation of another's act; 2. The first pictorial was the result of accidental resemblance in scribbling; 3. Up to 4 years of age, forms of beauty were less interesting than objects; 4. There was a tendency to generalize, especially detail, and to conventionalize; 5. Form proved to be more interesting than color.

Gallagher (quoted by Hart (15)) made an analysis of the spontaneous drawings of children from five to fifteen years of age. She noted that the tendency to draw people increased to the sixth year, then declined; drawing of trees and horses increased to the seventh year, then declined; conventional designs increased from the seventh to the twelfth year, then declined. And, drawings of birds, animals, plants, engines, cars, tools and stores rose and fell erratically. Small children use size for emphasis, and they draw what interests them.

What type of drawing children from six to twelve years of age will make to illustrate a hymn referring to God, stars, clouds and angels, was studied by Hart (15). There was found to be a steady increase in the drawing of stars, sky and clouds with an increase in chronological age, and a steady decrease in the number of drawings which depicted God, angels and the earth.

Burk (8) in a study of the "Genetic versus the Logical Order in Drawing," found three periods of development which are; first, a period of wholly muscular movements, unguided by visual centers in any degree, which occurs in the second and third years; second, the beginning of crude representation, which slowly proceeds toward interest in accurate drawing of objects as really seen. This period, from the fourth to the ninth or tenth year, is characterized by the fact that the visual centers show evidence of inability to control the delicate muscles of the arm, hand and fingers; third, the beginning of interest in the accurate representation of what the eye sees and the exclusion of associated ideas. The child has practically no interest in conventional designs and in abstract, geometrical forms, since drawing is a language for the expression of his ideas.

In 1913, Thorndike (31) devised a scale to rate the child's achievement in drawing. Drawings of children from eight to fifteen years of age were collected and their value in degrees of merit was judged numerically, as established by a majority of judgments. The purpose of this scale was to provide an objective measure for marking drawings.

Baldwin (3) and Waddle (32), in brief discussions of children's drawings, have attempted to show that they develop in a manner similar to the art of primitive man. The drawings, according to them, begin with meaningless lines and progress through a stage in which lines have meanings, a stage where decorations predominate, and finally, a stage of picture writing. All of these stages are an outgrowth of self-expression which results in an increasing capacity for appreciation and enjoyment.

Stern (30) has expressed a similar idea in stating that children's drawings are merely efforts to "mark down their ideas of things; that pleasure in drawing is more universal in the first than in the latter years of life, for children scribble away gayly, and are not troubled by the inadequacy of their representations. For this reason, elders must not look at children's drawings from an aesthetic point of view, but rejoice that their perceptual life finds in them new and unrestrained expression." According to Kirkpatrick (27), the child, in the early stages of drawing, considers his drawing a success if he knows what the lines stand for. Later, he judges it to be successful if his lines are so made and related that others know what he means.

McCarty (23), in a study of 31,239 spontaneous drawings, gathered from sections representing all parts of the United States, and made by children ranging in age from four years to eight years eleven months, found results similar to those of Maitland (22). Interest in the human form, fruits, vegetables and insects decreases with age, while interest in buildings, wildbirds, sun, moon, stars, trees, flowers, geographical conceptions and composition increase with age. Toys reach a high point of interest in the fifth years; toys and vehicles in the sixth and seventh years. No real differences between the drawing interests of boys and girls was found to exist.

As a means of establishing the relationship between children's drawings and their intelligence, Goodenough (12, 13, 14) analyzed 1,000 drawings made by children from kindergarten through the first four school grades. The object drawn was the human form and the drawings were analyzed to establish a norm for each age and class level. She found that the order of develpment in drawing is remarkably constant, even among children of very different social antecedents, and that there is a close relationship between concept development, as shown in drawing, and general intelligence. On the basis of these findings, she developed a "drawing test" as a means of measuring the intelligence of young children.

Luguet (19, 20) has indicated that children's drawing passes through four stages, which are as follows: (1) Involuntary drawing, in which the child, at first, does not know that his lines can represent something; (2) The child tries to synthesize the details of his drawings for the exclusive purpose of representing each one for its own sake; (3) The child synthesizes his details and includes the details of the objects he sees. This is the period of "intellectual realism"; (4) The period of "visual realism," in which particular attention is given to perspective.

Bühler (7) has concluded that children's drawings pass through six stages of development which are as follows: 1. Preliminary scribbling, which leads through accidental resemblance to a representative function; 2. Drawing from memory, "out of his head;" 3. Portraying objects with their constant and essential attributes only; 4. Drawing to give a "graphic account," in which errors in spatial relationships and errors in translation of knowledge are to be expected; 5. Drawing synthetically, consisting of addition of part after part; and, 6. Realistic drawing.

Experimental procedure

The experiment reported in the following pages was carried out by the junior writer. Every child in the kindergarten, first and second grades of four schools was given a piece of paper, 6 x 9 inches, and was asked to draw a picture of a man, any kind of man he wished to make. No time limit was set and the children were permitted to use pencils, crayons or both, according to their individual wishes. After this drawing was finished, the children were asked to draw in turn seven other objects; a girl, a house, a dog, a tree, a flower, an automobile and a boat. These objects were chosen not only because they were assumed to be familiar to every child and thus could be drawn from memory, but also because in many previously reported studies, they were found to be among the child's chief drawing interests.

The schools used in this experiment have, as a part of the daily routine, some time set aside every school day for drawing, but no drawing is taught before the second grade and, even then, at least 80 per cent of the children's drawings are free and imaginative. With the exception, therefore, of the drawings done by the children between 7½ and 8½ years of age, those included in this experiment were practically free from the influence of any formal teaching.

The younger the children, the less time was needed to produce the eight drawings asked for. The children of the kindergarten ages finished in an hour and clamored for more drawing opportunities. The first grade children needed an hour and a half and the second graders, two hours or more. There was a marked difference between the older and younger children in the amount of confidence and discrimination shown in their drawings. Kindergarten children cheerfully and confidently drew any object and were usually *satisfied* with their results. The first graders were willing to attempt anything, but were often critical of their results. The second graders, on the other hand, were often skeptical of their abilities even before beginning to draw and made discriminating remarks about the finished products.

Subjects. As the object of this experiment was to discover what children perceive at four different age levels, the grouping of the children was made on that basis, rather than upon their school grades. No children were younger than 4½ years, and none were older than 8 years and 5 months. They were grouped as follows:

Level I. Children from 4 yrs. 6 mos. to 5 yrs. 5 mos.
Level II. Children from 5 yrs. 6 mos. to 6 yrs. 5 mos.
Level III. Children from 6 yrs. 6 mos. to 7 yrs. 5 mos.
Level IV. Children from 7 yrs. 6 mos. to 8 yrs. 5 mos.

These levels including numbers, sex, and intelligence quotients are given in table 1.

The children of each age level were classified according to Terman's five intelligence groups, as follows:

Dull	80–89
Dull normal	90–109
Superior	110–119
Very superior	120–139
Near genius	140–

Levels I and II included all five groups; Levels III and IV only the first four.

RESULTS

In classifying the 2,292 drawings made by the children used in this study, all drawings for each of the intelligence level groups were analyzed under the headings of "General," "Specific," "Background," "Association of Ideas," "Color" and "Design." In addition to these common factors, each object was analyzed according to its individual details, the smallest number appearing in the drawing of flowers, and the largest in those of a man and a girl. The number of times each thing included in the analyses appeared in a given group, was noted, and given in terms of percentage, as will be seen in the following tables. The crudest effort to draw any detail was counted. Objects were considered "general," unless specific qualities were evident; any picture featuring sky, grass, water or horizon line was credited with "background;" any additional details as, a kennel for a dog, or a dock for a boat were called "associated ideas;" color was counted as correct except in such absurd cases as a man with green hair, or a dog with a blue tail; and design was credited to any picture which definitely showed a nicety of balance in color or form. This was included because the writers constantly noted that children added a balancing detail to those pictures which seemed one-sided. There was no evidence of attempts at formal design except in the dresses of the little girls, or in the gardens, which was often the form chosen for flower drawing.

Tables 2 to 9 gives a complete analysis of the details of the different drawings made by the children. The results are presented in terms of the percentage of appearance in each age level. Because of the relatively small number of subjects of the different I. Q. levels within each age level, no attempt was made to analyze the results in terms of the I. Q. scores.

TABLE 1

Classification of subjects

I. Q. RANGE	AGE LEVELS												TOTAL
	4 years 6 months to 5 years 5 months			5 years 6 months to 6 years 5 months			6 years 6 months to 7 years 5 months			7 years 6 months to 8 years 5 months			
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	
80– 89	1	0	1	2	0	2	2	0	2	3	1	4	9
90–109	14	10	24	23	18	41	20	18	38	13	13	26	129
110–119	4	9	13	17	16	33	13	16	29	9	3	12	87
120–139	8	7	15	7	7	14	8	8	16	5	5	10	55
140–	0	3	3	0	1	1	0	0	0	0	0	0	4
Totals...	27	29	56	49	42	91	43	42	85	30	22	52	284

TABLE 2

Analysis of details of drawings of a man

(In terms of percentage of appearance in each age level)

	GENERAL	SPECIFIC	HEAD	HAIR	HAT	FEATURES	EARS	TRUNKS	BUTTONS	ARMS	FINGERS, 5–	FINGERS, 5	FINGERS, 5+	LEGS	FEET	SHOES	STOCKINGS	BACKGROUND	ASSOCIATION OF IDEAS	COLOR	DESIGN
Level I.........	100		100	15	19	56	12	68	27	65	11	19		72	51	6	1	33	14	41	17
Level II........	99	1	100	31	29	81	54	89	32	78	86	6	2	77	88	55	27	22	29	31	4
Level III.......	87	13	100	40	70	100	20	99	35	95	15	12	2	100	70	55	30	62	25	100	21
Level IV.......	81	19	100	27	68	100	23	100	20	97	6	8	6	100	95	88	41	56	40	97	26

TABLE 3

Analysis of details of drawings of a girl

(In terms of percentage of appearance in each age level)

	GENERAL	SPECIFIC	HEAD	HAIR	HAT	FEATURES	EARS	TRUNKS	BUTTONS	ARMS	FINGERS, 5–	FINGERS, 5	FINGERS, 5+	LEGS	FEET	SHOES	STOCKINGS	BACKGROUND	ASSOCIATION OF IDEAS	COLOR	DESIGN
Level I.........	100		100	20	6	70	15	90	27	55	18	9		92	58	8	5	31	17	7	2
Level II........	100		100	64	10	98	2	88	16	62	27	5		99	87	52	16	17	7	74	25
Level III.......	98	2	100	54	15	100	6	100	10	65	15	2	1	100	71	49	42	65	23	97	8
Level IV.......	95	5	100	65	30	100	9	100	8	84	17	14		99	99	82	78	58	30	100	36

These tables show that the tendency to perceive the specific, rather than the general, in familiar objects, increases steadily with age. This is true in each of the eight objects drawn, and is in keeping with the findings of Shinn (Brown, 6) who wrote that her niece drew objects of a general type before attempting the specific. Barnes (4), Baldwin (3), Waddle (32), Stern (30) and Bühler (7) noted the tendency to draw lines which stood for simple

TABLE 4

Analysis of details of drawings of a house

(In terms of percentage of appearance in each age level)

	GENERAL	SPECIFIC	CHIMNEY (PERPENDICULAR)	CHIMNEY (SLANTING TO LEFT)	CHIMNEY (AT RIGHT ANGLES ON LEFT)	CURTAINS	PORCHES	STEPS	BACKGROUND	ASSOCIATION OF IDEAS	COLOR	DESIGN
Level I..............	100		15	4	8	18	2	9	35	8	59	9
Level II.............	98	2	29	10	36	44	15	4	57	37	89	45
Level III............	98	2	39	2	38	44	16	14	73	23	100	47
Level IV.............	97	3	39	4	28	67	9	23	87	51	100	67

TABLE 5

Analysis of details of drawings of a dog

(In terms of percentage of appearance in each age level)

	GENERAL	SPECIFIC	HEAD	EARS	TAIL	LEGS 2	LEGS 4	ORGANS	COLLAR	BACKGROUND	ASSOCIATION OF IDEAS	COLOR	DESIGN
Level I.........	100		96	16	68	79	18	9		32	24	37	12
Level II........	91	9	100	56	67	39	57	1	24	41	29	70	1
Level III.......	83	17	100	61	84	60	41	1	10	63	20	87	5
Level IV.......	69	31	100	84	100	38	63	2	11	74	28	100	23

TABLE 6

Analysis of details of drawings of a tree

(In terms of percentage of appearance in each age level)

	GENERAL	SPECIFIC	MASS	BRANCHES	LEAVES	FRUIT	BACKGROUND	ASSOCIATION OF IDEAS	COLOR	DESIGN
Level I...........	89	11	47	54	37	11	31	20	59	12
Level II..........	96	4	31	79	40	4	48	32	86	8
Level III.........	97	3	49	51	19	3	65	18	85	24
Level IV..........	89	11	43	59	16	3	83	6	100	38

essentials, then symbols standing for objects, before truly representative drawing occurred.

TABLE 7

Analysis of details of drawings of a flower

(In terms of percentage of appearance in each age level)

	GENERAL	SPECIFIC	PETALS	LEAVES	BACKGROUND	ASSOCIATION OF IDEAS	COLOR	DESIGN
Level I	100		29	31	48	8	32	33
Level II	89	11	38	83	64	25	70	12
Level III	94	6	49	86	65	14	71	37
Level IV	48	52	86	83	83	7	100	43

TABLE 8

Analysis of details of drawings of an automobile

(In terms of percentage of appearance in each age level)

	GENERAL	SPECIFIC	DOORS	WINDOWS	STEERING WHEEL	GUARDS	LIGHTS	HOODLINES	HOOD CAP	BUMPERS	BACKGROUND	ASSOCIATION OF IDEAS	COLOR	DESIGN
Level I	98	2	41	45	22	7	15	31	6	1	18	11	100	7
Level II	99	1	39	42	12	16	3	48	27	25	42	41	100	8
Level III	94	6	50	60	27	21	14	66	35	14	84	20	100	14
Level IV	74	26	53	87	35	54	19	83	48	39	64	32	100	21

TABLE 9

Analysis of details of drawings of a boat

(In terms of percentage of appearance in each age level)

	GENERAL	SPECIFIC	STERN	BOW	OARS	SAILS	FUNNELS	PORT HOLES	BACKGROUND	ASSOCIATION OF IDEAS	COLOR	DESIGN
Level I	99	1	10	10	2	4	30	29	62	9	57	29
Level II	93	7	35	35	1	43	24	30	70	36	80	27
Level III	62	38	30	39	1	28	48	67	81	20	100	28
Level IV	52	48	46	46	13	27	47	38	98	27	100	31

The tendency to perceive background and color placement increases with age, and, to a lesser degree with intelligence. As far as the writers know, no studies of children's drawings have included an evaluation of background. As the children of this experiment have been allowed to use drawing, freely, as a means of self-expression, the fact that they so frequently include it seems significant. Three times in 32 age level groupings, the average percentage of background is less than 30; nine times it is more than 30; fourteen times it is more than 50; and six times it is more than 80. The amount of freedom allowed these children in their drawing has made it possible for them to draw from their "own consciousness of things" (Lukens, 21), and to "mark down their ideas of things" (Stern, 30). Our tables give substantial evidence that their consciousness and ideas of things are according to the laws of perception as stated by Koffka (18), viz., that perception is an inclusive experience, and that a figure cannot be perceived without color, or darkness or light, spatial relationships, position and direction.

Color was always present, as the children used crayons in every drawing, but in the tables, color is only marked if used appropriately. The children of the youngest age level used color for the pleasure such colors offered them, "naturally," (Barnes, 4) and "with interest" (Chapman, quoted by Brown, 6). Its appropriate use, by the children of the second level increased 65 per cent over that of the first level, and each level above increased to some degree.

The tendency to perceive associated objects and design also increases with age, but no relationship is shown between this increase and intelligence. Exceptions are noted on Level IV, in the case of objects associated with a tree and a flower; exceptions in the increase of design occurred on Level III with the drawing of a girl, and on Level II with the drawing of a tree. The observations of the writer during the experiment, and those of several teachers during any drawing periods, suggest a very close relationship between association of ideas and design. The association of ideas appeared to grow from the children's desire for a balance of form or color, rather than from a wish for associated objects. For instance, a child would draw a man and hold it up for the teacher or writer to see. If the drawing had not been placed in the center of the paper, and it seldom had, he would seize a crayon of any color, and add some associated object which nicely balanced the 6 x 9 paper. The nature of the addition seemed to depend upon the color of the crayon. If it happened to be orange, he would add a sun; if green, a cluster of flower stems, and perhaps colored tops would follow. One boy drew a dog, attached to a leash, held by a willowy, uncertain looking man. He offered his drawing to the writer, then withdrew it, saying, "I'll put a cane in the man's other hand—that'll hold him up." Apparently the man had been drawn to balance the dog, which had been placed below the center of the paper.

There is little evidence of interest in formal design, which is in keeping with the studies made by Shinn (Brown, 6), Maitland (22) and Burk (8), all of whom stated that conventional design made little appeal to young children; seldom younger than 11 years, according to Maitland. The few attempts at conventional design noted in the present experiment, were in the drawings of little girls' dresses, Indian wigwams (the result of an Indian project), and in flowers and gardens.

The interpretation of the details of specific objects is difficult, as, with the exception of the man and the girl, the variety included differs. Generally speaking, the number and accuracy of details perceived increase with age and with intelligence. Attention will be called to one *detail* drawn in each of every object, excepting the man and girl, in which all details will be discussed. And the different placement of chimneys will be used as examples of increased accuracy. Beginning with Level I, the average of the I. Q. percentages of window curtains in the drawing of houses on each age level are 18, 44, 44 and 67, respectively. Percentages in the drawing of dogs' ears are 16, 56, 61 and 84; of branches on a tree 54, 79, 51 and 59; of petals on a flower 29, 38, 49 and 86; of hood lines on an automobile 31, 48, 66 and 83; and of boats showing bows and sterns 10, 35, 39 and 46. In the drawings of the man and the girl, the percentages showing hair, hats, features, arms and stockings always increase with age level, and, with one exception, this is true in the drawing of trunks, legs and shoes. The percentages of ears and feet drawn fluctuate, and of buttons and fingers, decrease with age. The accurate placing of chimneys on gabled roofs, increases with age more constantly than with intelligence. (All roofs were gabled; all placing was correct except in such cases as chimneys slanting to right.)

The tendency for the perception of details to increase with age is as would be expected from studies made by O'Shea (26), Burk (8), Judd and Cowling (17), McCarty (23), Goodenough (14), and Bühler (7). The tendency for certain details to decrease with age is probably due to the fact that a child can only give his attention to a limited number of things at a time, and buttons and fingers certainly play a relatively more important part in the life of a four year old, than of a six year old child. O'Shea (26) says that children's experience with things causes them to draw any combination of their characteristics. Another reason may be due to a child's increasing appreciation of relative size, as stated by Chapman (Brown, 6) and Gallagher (Hart, 15). Some of the older children in this experiment criticized the drawing of fingers because they were "too large for the picture." And the tendency to conceal the fingers by drawing the hands in pockets, or holding something, or as doubled up in fists, increased with age. Also, there was an increasing tendency to cover the ears with hair or hats.

During the experiment the writers noted that the older children showed less pleasure in drawing the human form than in any of the other objects. In each group ranging from 6½ to 7½ years, at least five children had to be *urged* to draw a man or a girl, and the number doubled in the 7½ to 8½ year group. One of the latter refused, saying he couldn't draw a man that looked like one. So the writer suggested that he draw a picture of any kind, and put a man in it. Fifteen minutes later, he presented her with a picture of a beautifully arched bridge, from which a man was fishing. His shins and feet were hidden by the bridge, and his body and face well concealed by an overcoat and soft hat! The general decrease in confidence attending the increase of age and discrimination, is in keeping with the findings of Clark (9), Burk (8) and Bühler (7). The writers could find no evidence that there was less *interest* among older than among younger children, as stated by Clark (9), Gallagher (Hart, 15) and Lukens (21). Human forms were frequently added to the pictures of the six other objects in this experiment, but the older children showed much less *satisfaction* in the human forms drawn, than they did in houses, automobiles and boats.

SUMMARY

The following statements offer a summary of the findings of this experiment:

1. The tendency to perceive the specific rather than the general increases with age.

2. The tendency to perceive background and color placement increases with age, and to a lesser degree, with intelligence. But the perception of both background and color is present to some degree on each age level.

3. The tendency to perceive associated objects and design increases with age, but shows little relationship to intelligence. Of the two, design, when considered in terms of balance, seems the stronger tendency.

4. The tendency to perceive details increases with age and with intelligence.

5. The accuracy of perceptions increases with age, and to a lesser degree, with intelligence.

6. As perceptions become more discriminating on higher age levels, confidence in the ability to draw decreases.

7. The ability to give *artistic* expression through drawing shows little relationship to age or intelligence.

8. Between the ages of 4½ and 8½ years, inclusively, the ability for accurate and detailed perception, shows a more constant relationship to chronological age than to intelligence.

9. That further collections of drawings made by children who have been allowed to draw freely, as a means of self-expression, would offer valuable material for psychological study. The persistent tendency to perceive background, is in keeping with Koffka's statements of the laws of perception, in his introduction to the theory of *Gestalt Psychology*.

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An Analysis of Two Hundred Quarrels of Preschool Children

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DESPITE the modern interest in child development and in personality, maladjustment and social behavior, quarreling, a common type of child behavior has received little or no attention. Occasionally there is some discussion of quarrels in the literature on child training, in observational notes, and in child biographies. Sometimes quarrelsomeness appears as an item in rating scales for personality traits. What systematic treatment there is, is to be found mainly in the literature on anger, or incidental to studies of personality or social behavior.

The character of the studies made is indicated in the following review. With some types of investigation as summarized by Goodenough (14), we need not concern ourselves: for example, the theoretical literature on the nature of emotions, the physiological and neurological studies of anger, increased irascibility in certain mental and nervous diseases, racial differences in irascibility, etc.

Questionnaire studies. In a questionnaire study Hall (16) in 1899 made one of the earliest attempts to present a systematic account of anger. He attempted an analysis of factors which arouse anger, factors which increase irritability, and of characteristic age and sex differences in physical manifestations. Very young children, he said, vent their anger with no reference to the adversary; screaming and crying were the most characteristic vocal responses. More recently Gates (13) found from records of anger experiences of college women that the mean number of episodes for the week was 2.85; the modal duration was from ten to twenty minutes; 51 per cent of the episodes were followed by unfavorable after-reactions of some kind. A similar study by Richardson (22) on college men suggested that anger occurred somewhat more frequently among the male subjects.

The data for a more recent and comprehensive study of anger by Goodenough (14) were obtained from record blanks kept over a period of a month by the mothers of 45 children. A total of 1878 anger outbursts were analyzed for: sex and age differences in motor and vocal behavior during anger; types of reaction classified as "undirected energy," "resistant," or "retaliative"; frequency and duration of outbursts; factors contributing to increased irritability; activities during which anger occurs; causes of anger; number of outbursts and their relation to such factors as health, number of adults in the home, time of day; and methods of control and their effectiveness. Goodenough found that problems of social adjustment constituted the most frequent single source of anger outbursts among children. They made up 28.1 per cent of the entire number reported for the group.

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Studies of personality traits. In certain studies of personality characteristics we find some phases of aggressiveness, or quarrelsomeness and their relation to other factors studied. Stratton (24) obtained a correlation of −.102 ±.016 between emotion scores and academic grades of college students, indicating that success in scholarly work is more probable the less the individual is inclined to anger. Allport (1) made personality graphs for 55 college students from data which included questions on anger experiences. A study by Goodenough and Leahy (15), the "Effect of Certain Family Relationships upon the Development of Personality" considered certain aspects of quarrelsomeness. Levy (17), studying the resistant behavior of 983 infants and children during psychological testing, found age differences in patterns of behavior. Olson (20) found a negative correlation existed at all ages between general intelligence and problem tendencies in school children.

Rating scales and inventories. Scales such as the Marston Introversion-Extroversion scale (18), the Woodworth-Matthews Personal Data Sheet, and a scale used at the Merrill-Palmer school contain items referring to the subject's social behavior. The behavior inventory designed by Andrus (2) covers a wide range of behavior items many of which refer definitely to our problem; for instance, strike in self-defense when attacked, let others take toys without protest.

Studies of social behavior. Phases of activity which are related to quarreling have been studied in a manner more similar to the present investigation as a result of the newer emphasis on social behavior. One of the earliest studies of this type by Verry (26) included coöperating with the group as one of the five types of social attitudes among pre-school children which she described. Studies by Thomas (25) and her associates at Teachers' College have revealed individual differences in types of response to social contacts, classified as passivity, coöperation, resistance, and flight. Parten's investigation (21) represented a systematic approach to the study of social behavior. The emphasis, however, is more on whether or not the child joined a group and what rôle he played in it, rather than on the actual adjustments and relations between the children in that group. Challman (11) aimed by a systematic approach to determine what factors operated in determining the friendship of young children. Bott's observation (5) of play activities in a nursery school included "relations with other children" as one category in the types of behavior recorded.

Studies devoted almost solely to quarreling. Using the data procured from a questionnaire issued by Hall in 1885

Burk (9) presented a study on teasing and bullying. His analysis, largely descriptive, treated such aspects as: the various forms of teasing and bullying, and the type of reaction in the victim. He found that boys exceeded girls in the number of tormentors. The source of data for Bovet's (6) "The Fighting Instinct," was 500 school-boy compositions on "When Children Fight, Why Do They Fight. Tell the Story of a Fight You Have Seen." Bovet listed various stages in a fight and described their order of appearance; the causes of quarrels he assigned to an instinct. Because of the theoretical views and the inadequate treatment of the data, the results of the study are of little value to us, but it is mentioned because it is one of the few investigations to deal solely with quarreling.

Experimental studies. Lastly, there are a few experimental studies which investigate the relations between two children in a situation so arranged that conflict easily and almost necessarily, arises. One of the first was made by Bühler (8) upon 114 nursing children. They were placed in a room by pairs, given various toys and their reactions in adjusting to the situation were recorded. By the end of the first year definite individual differences in response had appeared.

Using a similar, but more objective and controlled method, Walker (27) investigated domination and subordination in social interaction among nursery school children. An unseen observer recorded the behavior every five seconds during a six minute period in specified categories; for example, screamed, pleaded, relinquished passively. Consistent differences appeared in the behavior of each child. Mengert (19) made a similar study on ten two-year old children. One point was given for each instance of friendly or unfriendly behavior in the minute in which it occurred; and a final friendliness score was computed. She too found considerable consistency in the behavior of individual children.

Summary. In summary, the studies that deal with quarreling systematically are few in number. For the most part the subject has been treated more or less incidentally under various other topics. Thus, the questionnaire studies on anger listed some situations which were social in nature and which might have provoked quarreling (although the majority of these questionnaires were given to adults only). Rating scales and personal data inventories, studies of personality characteristics, of behavior problems and studies of social behavior also investigated various phases of adjustment, some recording quarreling quite directly, others more or less casually. Finally, there were studies devoted solely to quarreling such as the older questionnaire studies on teasing and bullying and on fighting among school boys. And more recently, there have been experimental investigations of the reactions of young children when paired in conflict-arousing situations. Very few of these, however, have attempted an analysis of the quarrel situation itself.

METHOD

Purpose. The present investigation aims to study and analyze the quarrels of preschool children as they arise spontaneously in a relatively uncontrolled social environment. The morning free-play period was chosen for observation because then teacher-control is at a minimum.

Place and time. The study was carried out at the nursery school of the Institute of Child Welfare, University of Minnesota, during the fall and winter of 1931 and 1932. The data are based on 200 quarrels recorded during the period from October 19th to February 17th.

Subjects. The subjects were 40 nursery school children, 19 girls, 21 boys, ranging in age from twenty-five months to sixty months, with a median age of 43.5 months. The median age of the boys was 38 months, of the girls 44 months. Their IQ's ranged from 90 to 131 with a median of 106. These children are selected to be a representative sampling of the distribution of occupations in Minneapolis, grouped according to the Minnesota occupational rating scale. Actually the distribution is skewed since children whose parents belong in the lowest occupational groups, which shift from one locality to another, are difficult to obtain.

Procedure. An observational technique, the behavior sampling method was employed. To keep conditions as constant as possible the children were observed during the morning free-play period, which lasts approximately from 9:15 to 10:30.

In order to view the group as a whole, the observer watched the children from some central spot on the playground or from the doorway between the two main playrooms. When a quarrel developed the observer moved quickly to the scene of action as unobtrusively as possible. Since all the children were quite accustomed to the presence of a number of observers—all armed with stop watches, notebooks and the paraphernalia necessary to research—it is not felt that the children were at all influenced by this record taking.

The procedure was to start the stop watch immediately upon noting evidences of a struggle, and to stop it when the issue was settled or when the teacher interfered. The observer did no recording during this time but devoted her whole attention to the quarrel. Immediately after, the record blank was completely filled out before continuing the observations, even if this meant missing some other quarrel. As the quarrels were of very short duration it is felt that errors of memory were thus reduced to a minimum. Running notes descriptive of the quarrel were taken as well, for they provide details that the categories do not give and are particularly valuable when one refers to the record at a later date.

Obviously the number of quarrels is an underestimate, for some were necessarily omitted or not noticed. This happened, of course, when one occurred while the observer was filling out a record blank, when more than one occurred at the same time, or when the observer noticed the quarrel too late to record the cause. In any cases in which the cause was ambiguous the record was not used.

Explanation of categories. Mimeographed blanks prepared in advance provided space for recording and checking the name, age and sex of the children, the duration of the quarrel, what the children were doing and what difficulty arose, the types of behavior under proper categories (to be described), the motor and vocal activity, the outcome of the quarrel, and the after effects. The items on the record blank were derived partly from the questionnaire forms used in Goodenough's study "Anger in Young Children" (14).

Since the difficulties over which the quarrels started were almost as numerous in kind as the total number of quarrels some classification had to be made. Four categories were decided upon: possessions, physical violence, interference with activity, and social adjustment. The first type included, for instance, quarrels originating over a child's desire for another's doll, or a child's refusal to give up a swing. Difficulties were classified as physical violence when started, for example, by one child's slapping another, or throwing snow or sand. Interference with activity would be illustrated by one child's refusing to move his sled from the slide or by barring a child's way on the walking board. Examples of difficulties over social adjustment would be: "I don't want you to play in my house," or "Only girls can slide here."

The categories under *type of behavior* were used to describe the activity of the child during the quarrel. They were defined as follows:

Non-participator was a child who was in a group in which a quarrel occurred but who took no part in the quarrel.

The *precipitator* was the individual who caused the quarrel in the sense that he started it; for example, Stephen snatched Faith's doll; or, Samuel wanted to get in the rocking boat so he tried to stop it in spite of the objections of those already in it. The precipitator did not always nor necessarily take the aggressive part in the quarrel; thus, Wanda precipitated a quarrel by knocking over a block in the "house." The other children took the aggressive rôle in attacking her.

Under *aggressive behavior* was recorded the name of the child who took the more aggressive part in the quarrel; for example, Walter (precipitator) snatched Marjorie's dish; she (objecting) said "That's mine;" Walter (aggressor) hit her and she immediately gave up the dish. When it was difficult to tell who was the more aggressive of the quarrelers the category "aggressive" was left blank. This was done in 36 of the 200 quarrels. As an instance, Lois threw sand on Cora. Cora pushed Lois and the quarrel was over.

Retaliative behavior implied attacking in response to attack. Thus, David who objected to Walter's shutting the door in his face, pushed and struck him; Walter pushed in return and threatened to throw snow at David as they struggled.

In *objecting behavior* the child resisted or objected to the action of the other child, or children, but did not go so far as to retaliate. Thus, he might have said "no" or "stop," but there was no directed attack upon the offender.

Undirected energy involved crying and screaming, jumping up and down, or stamping, without any directed resistance. It was also unverbalized; if the child said "no" or "don't," for example, his behavior was classified as objecting.

No observable response to attack, and no vocalization was classified as *passive behavior.* To illustrate, Lois sat down in Wilma's chair. Wilma said "get out," pushed and pulled Lois out of the chair; Lois left without resistance.

Occasionally the type of behavior changed during the course of the quarrel, perhaps from objecting to retaliation. In this event the more directed form of attack, thus retaliation was checked.

Under *activity* the various forms of motor and vocal behavior displayed during the quarrel were checked for each child. Whenever possible, conversation was recorded. Under "forbid" were included such remarks as "don't," "no," "stop"; under "command" were included "get out," "go away," etc.

Cheerful was checked for the child who resumed his play after a quarrel apparently happy, without showing signs of ill-will or annoyance. A child was recorded as *resentful* if he scolded, whined, complained to the other children or to the teacher, or seemed in any way upset by the quarrel.

Entries were made after *child yielded* and *issue yielded voluntarily* to indicate more clearly the conditions of the yielding. The former means that the child yielded to force on the part of another child; and a further note was made to indicate to whom the child was forced to yield and the type of his reactions before yielding. Thus "Faith Y to F Wanda; obj." means that Faith yielded to force on the part of Wanda after objecting. The category *issue yielded voluntarily* was made to cover those instances in which no child was forced to yield, but where the aggressor apparently abandoned the issue over which the quarrel arose; that is, the one who seemed to be winning gave in to the loser. To illustrate, Simon took Sue's dish. She cried and stamped and Simon gave the dish back.

In occasional instances the quarrelers *compromised.* For example, Bruce and Alfred were playing with the trains; Alfred pulled the train apart, whereupon Bruce hit him. Alfred in turn struck Bruce and then the two joined efforts in putting the train together again.

Unsettled quarrels were those which the teacher (on rare occasions another child) interrupted.

Reliability. To test the consistency on the record-taking, a second observer made independent records of ten of the quarrels. There were two instances of disagreement in classifying the type of difficulty, and two in classifying the issue because of the second observer's misinterpretation of a category. There was disagreement in recording the type of behavior for one child, and the after effects for two children. The author's greater practice in record taking enabled her to make more complete records of motor and vocal activity. Except for these items the records of the two observers were identical.

The rank order correlation for individual frequency of quarreling between the first 100 and second 100 quarrels is .63 ±.07. Applying the Spearman-Brown prophecy formula this becomes .77. The rank order correlation for the individual frequency of quarreling for the 200 quarrels, determined by the odd-even method is .83 ±.03. This is raised to .91 by the Spearman-Brown formula. See table 3.

Since the character of the data renders it difficult to calculate a simple numerical score for the consistency of the other results, the author computed separately the results for the first 100 and for the second 100 and for the total 200 quarrels. In treating the first 100 and second 100 quarrels separately we are, in effect, applying the basic concept of reliability; that is, we are virtually repeating the experiment. The results for the two halves showed marked similarities; hence, for the sake of brevity the author is presenting here only the figures for the total 200 quarrels.

Sources of error in method. As mentioned before the number of quarrels recorded is an underestimate of the total number that occurred and this may have resulted in unequal emphasis on those of certain children. Again, since only the overt after-effects are noticeable, possible cases of concealed resentment would have been unobserved. More adequate treatment of the child who is drawn into a quarrel when he happens to be near the scene of action would be desirable.

The consistency of the second observer's records with those of the author would seem to indicate that errors from misinterpretation are confined mainly to the type of difficulty and to the issue; a more objective method of classification would be of value here. Although the number of cases when divided into age groups is small, the greater number of quarrels at each age group minimizes the difficulty, for this is not primarily a normative study but rather an analysis of the quarrel-situation.

FREQUENCY AND DURATION OF QUARRELS

Average number of quarrels per hour. The results for frequency and duration of quarrels are shown in table 1. For the total 200 quarrels there are 58.75 hours of observation with an average of 3.4 quarrels per hour. The smallest number in an hour is one, the maximum nine. Studies on adult subjects, for example by Gates (13) and Richardson (22), showed anger outbursts much less frequent, yet this

TABLE 1

Frequency and duration of quarrels

Hours of observation	58.75
Average number of quarrels per hour	3.40
Number outdoors	68
Number indoors	132
Average number of children per quarrel	2.22

Duration of quarrels in seconds

	OUT-DOORS	INDOORS	ALL
Average	34.48	18.45	23.63
Median	21	13	14

Individual frequencies

Total individual frequencies	444
Average number of quarrels per child	12
Range in number of quarrels per child	0–30
Total quarrels for boys	271
Total quarrels for girls	173
Average number of quarrels for boys.	13.55
Average number of quarrels for girls.	9.61

undoubtedly is largely the result of repression by social forces.

Quarrels outdoors—quarrels indoors. There are 68 quarrels outdoors, and 132 indoors. The greater number of quarrels indoors is partly the result of more time being spent in indoor observation, yet the impression is that the children quarrel more frequently when they are in more crowded quarters.

Average duration of the quarrels. The duration of these quarrels is amazingly short. The range is from four to one hundred seventy-nine seconds; the average is 23.63. Of the 200 quarrels only 13 are a minute or over in duration. Table 1 gives the average and median duration for the quarrels.

Duration indoors and outdoors. The quarrels outdoors average 34.48 seconds in duration; those indoors average 18.45. The difference seems partly explainable by the fact that the children are more likely to chase each other around when outdoors.

Effect of teacher interference on duration. It was thought that perhaps the brevity of the quarrels was the result of the teacher's interference. To test this those quarrels in which the teacher took a hand are compared with those which the children settled themselves.

Outdoors the average duration of those quarrels in which the teacher interferred is 35.86 seconds; the average duration of quarrels with no interference is 34.54. Indoors, on the other hand, the average duration when the teacher interfered is 15.34; when there was no interference the average duration is 19.54 seconds. Although (as will be shown) the teachers interfered outdoors as often as indoors, evidently they terminated the quarrel indoors more quickly. This may be because the quarrels indoors are more disturbing in a situation where the children are playing closely together.

However, in any event the quarrels are so short that we may conclude that their brief duration is a true characteristic and not a function of interference on the part of the teacher.

Individual differences in duration. The average duration of all the quarrels in which each child engaged was also computed. A rank order correlation of .31 ±.105 between average duration and age indicates a slight tendency for the quarrels of the older children to last longer than those of the younger ones. See table 3. However, these average durations may not truly represent the individual children since the duration of the quarrel may be determined by a single child. A rank order correlation of −.09 ±.117 between average duration of the quarrels and frequency of quarreling indicates no relation.

When we compare these results with those found by Gates (13), Richardson (22) and others we may safely conclude that the quarrels of preschool children are remarkably shorter than those of adults. Reports would also indicate that these quarrels are shorter than those of older children. Certainly they are too brief to contain the various stages that Bovet described in his study of quarrels among school boys.

Average number of children involved. By totaling the individual frequencies in quarreling for all the quarrels it is found that the children quarreled 444 times, making an average of 2.22 children in each quarrel. The greatest number of children in a quarrel at any time was five. Parten found that children of this age play in small groups the greatest proportion of the time.

Average number of times children quarrel. For the 200 quarrels the children average approximately 12 quarrels each. The range is from 0–39.

Sex differences in frequency of quarreling. The sex differences in frequency are given in table 1. For all the quarrels combined the boys quarrel approximately 13.55 times each; the girls, 9.61. Comparing the frequencies for the sexes within the same age groups (see table 2) we find that the boys still exceed girls considerably in all but the 30–41 month group. It would seem, then, that the greater frequency of quarreling among boys is *a true sex difference.* The results of other investigations confirm this finding.

Age differences in frequency of quarreling. This study indicates that there is a tendency for quarrelsomeness to decrease with age. The rank order correlation between age and frequency of quarreling is –.41 ±.09. See table 3. Conclusions can not be certain because of the small number of cases, yet quarrelsomeness seems to *be a trait that changes with age.*

The question also arises here: are

TABLE 2

Age and sex differences in frequency of quarreling

(Expressed in number of quarrels per hour)

AGE	BOYS	GIRLS	ALL
54–65	.442	.210	.312
42–53	.689	.371	.527
30–41	.614	.699	.669
18–29*	.613		.613

* No girls in lowest age group.

TABLE 3

Correlations of frequencies and duration of quarrels with other factors

	P	SPEARMAN-BROWN CORRECTION
Reliability:		
Frequency of 1st 100 with frequency of 2nd 100.....	.63 ±.07	.77
Frequency of odd 100 with even 100...............	.83 ±.03	.91
Duration of quarrels:		
Average duration and increasing age................	.31 ±.105	
Average duration and frequency of quarrels.........	–.09 ±.117	
Frequency of quarrels:		
Gross frequency and equated frequency (1st 100)...	.97 ±.006	
Gross frequency and equated frequency (2nd 100)...	.94 ±.013	
Frequency and increasing age......................	–.41 ±.09	
Frequency and number of days present (1st 100)...	.13 ±.116	
Frequency and number of days present (2nd 100)...	.11 ±.111	
Frequency and IQ..................................	–.17 ±.114	
Frequency and number of different children with whom quarreled..................................	.95 ±.01	

the differences found functions of age and sex or of the personality of the individuals who make up the groups, or of both? That is, will two-year old Chester be as quarrelsome at five years as he is now; will he be any more quarrelsome than the average five-year old; will he be more or less quarrelsome than the average two-year old? The answer can be given only by repeating the study on larger numbers of children in both segregated and nonsegregated age and sex groups.

Frequency of quarreling and attendance. The frequencies were equated for absences because it was thought that the child who was present every day might exceed in frequency of quarreling the child who was absent a great deal, merely by virtue of the fact that he was present for observation more often. However, rank order coefficients of correlation between gross frequency and frequency after absences were equated of .97 ±.006 for the first 100 and of .94 ±.013 for the second 100 indicate that gross frequency is almost as good a measure as equated frequency. Coefficients of correlation between frequency of quarreling and number of days present are .13 ±.116 for the first 100 and .11 ±.111 for the second 100; this, too, would indicate that the number of days present has little effect upon frequency of quarreling.

Frequency of quarreling and IQ. The rank order coefficient of correlation between frequency of quarreling and IQ is −.17 ±.114 which indicates that the relation is slight. However, it is in the same direction as those found by Stratton (24) between IQ and emotion scores, and by Olson (20) between IQ and problem tendencies.

Frequency of quarreling and socio-economic status. The frequency of quarreling according to socio-economic status is presented in Table 4. Occupations are rated according to the Minnesota Occupational Rating Scale, in which Group I is professional, II, semi-professional and managerial, III, clerical, skilled trades and retail business, IV, semi-skilled occupations, minor clerical positions and minor business, V, slightly skilled trades and other occupations requiring little training or ability, VI, day laborers.

TABLE 4

Relation between frequency of quarreling and socio-economic status

(Showing average number of quarrels per hour)

Group I	.236	.331
Group II	.427	
Group III	.335	
Group IV	.269	.244
Group V	.219	

The implication that those of lower status quarrel less often is an interesting one but should be checked by studying a larger sampling, in order to ascertain whether these differences depend on the individual personalities within the group or whether they are truly affected by status.

SIMILARITIES IN AGE AND SEX OF CHILDREN WHO QUARREL TOGETHER

Number of different children with whom children quarrel. A chart was made showing every child with whom each child quarreled. The range for the 200 quarrels is from the child who quarreled once with one child to the one who quarreled 42 times with 29 different children. The average per child is 14.6 quarrels with 11.5 different children. In other words, the average child seems not to have any particular "enemies." As we would expect, a rank order coefficient of correlation of .95 ±.01 between frequency of quarreling and number of different children with whom the child quarreled indicates that those who quarrel most often quarrel with the greatest number of children. See table 3.

TABLE 5*

Similarity in age and sex of children who quarrel together

(Expressed in percentage of total number of quarrelers)

BY AGE	OLDER	SAME AGE	YOUNGER
54–65	3.7	30.3	65.8
42–53	18.6	44.6	36.7
30–41	38.1	48.8	13.1
18–29	73.5	26.4	0

All ages:
Between same age.............. 39.9
Between different ages......... 60.8

BY SEX	SAME SEX	OPPOSITE SEX
54–65	58.2	41.7
42–53	61.7	38.2
30–41	47.1	52.8
18–29	58.4	41.5
All	55.6	44.3

* The percentages in this and subsequent tables are based on the number of children involved in the quarrels. In all 200 quarrels the 40 children participated 444 times. The base for computing percentages for all ages was, therefore, 444.

Age and sex of those who quarrel together. Charts were made showing the age and sex of every child with whom each child quarreled. The percentages of quarrels with older children, children of the same age, younger children, and between those of the same, and of the opposite sex were computed. A range of six months was used to differentiate between the children. In general the children quarrel most often with those of the same sex but of different ages. See table 5. But the youngest and oldest children almost necessarily had to quarrel with children of a different age since other children of the same age were few in number. The quarrels of the middle groups of children, on the other hand, who have equal opportunity to quarrel with children older or younger than themselves are divided almost equally between those with children of the same age and those with children of different ages. Evidently then the age of those with whom the child quarrels is largely determined by opportunity. Whether the children would quarrel more frequently if the age groups were segregated, as they are in some nursery schools, is an interesting question.

ANALYSIS OF THE QUARRELING SITUATION

Difficulties over which quarrels start. As described before, the difficulties were classified into several categories. The percentages falling in each category are given in table 6.

Disregarding for the moment the age differences, we find that quarrels over possessions lead very clearly, with the rest of the quarrels divided about equally between the other types.

Age and sex differences in difficulties. Quarrels over possessions lead at all ages, the number of this type decreases consistently with age, and, in general, the number of quarrels of the other types increases with age. See table 6.

TABLE 6

Types of difficulties over which quarrels start

BY AGE	POSSESSIONS	PHYSICAL VIOLENCE	INTERFERE WITH ACTIVITY	SOCIAL ADJUSTMENT
54–65	38.4	26.9	10.2	15.3
42–53	53.9	12.6	22.2	11.1
30–41	61.0	11.6	15.5	11.6
18–29	73.5	8.8	14.7	2.9
All ages	58	13.5	18	10
BY SEX				
Boys	60.1	12.3	15.2	12.3
Girls	53.2	16.1	24.1	6.4

It is interesting to note that both the number of quarrels over possessions and the number of precipitators decrease with age. Since the majority of the quarrels originate over possessions it is not surprising to find the youngest children starting the most quarrels since they have not yet learned to share their toys.

Goodenough (14) found that difficulties over possessions reached a maximum frequency between the ages of three and four, while this study finds that the youngest children start the most quarrels. The difference between the studies, however, may very well be the result of differences in the social situation; the two year old at home would not be surrounded by children as near his own age, all wanting the same toy.

The boys consistently start more quarrels over possessions and over social adjustment than do the girls; while the girls consistently exceed in number of quarrels caused by physical violence and by interference with activity. Those of the "weaker" sex, at this tender age, have still to learn of the exclusive superiority of the male in the domain of brute force!

TABLE 7

Types of behavior exhibited by quarrelers

BY AGE	PRECIPITATOR	AGGRESSIVE	RETALIATIVE	OBJECTING	UNDIRECTED ENERGY	PASSIVE
54–65	39.3	65.1	47.0	7.6	0	4.5
42–53	37.9	48.2	59.6	10.8	4.2	3.6
30–41	47.5	36.4	47.5	16.1	6.8	7.3
18–29	68.0	24.0	34.0	16.0	18.0	14.0
All ages	45.0	43.7	50.5	12.8	6.1	6.3
BY SEX						
Boys	51.5	46.1	49.5	11.6	4.8	7.0
Girls	34.6	39.9	52.0	14.4	8.1	5.2

Type of behavior during the quarrel. Table 7 presents the percentage of quarrelers who displayed each type of behavior.

An interesting age difference is that the younger children start the most quarrels, and that the number of precipitators decreases with age. Although the younger children start more quarrels they take a less aggressive rôle during the actual struggle, or offer no resistance to the more violent behavior of the older children. But as the children grow older retaliation and aggressiveness increase. Both Hall (16) and Levy (17) found this same age difference when they noted that the resistant responses of older children became more definitely directed against the offending person or object.

TABLE 8

Motor activity exhibited by quarrelers

BY AGE	PUSHING	STRIKING	PULLING	KICKING	PINCHING	STAMPING	THROWING THINGS
54–65	40.9	36.3	30.3	9.1	1.5	0.0	0.0
42–53	40.3	36.1	32.5	6.0	2.4	1.2	1.2
30–41	22.6	32.5	38.6	1.2	5.5	3.1	2.4
18–29	18.3	28.5	22.4	0.0	0.0	4.1	2.4
All ages	31.3	34.0	33.3	4.1	3.1	2.0	2.9
BY SEX							
Boys	31.7	36.8	30.9	4.05	1.4	1.1	3.3
Girls	31.2	29.9	36.9	4.04	5.7	3.4	2.3

As for sex difference, the more aggressive behavior and the more frequent precipitation of quarrels on the part of the boys would seem to uphold the popular opinion that boys are more pugnacious than girls.

These types of behavior are undoubtedly affected by the age, and to some extent the sex, of those who quarrel together. For example, the behavior of the younger children is very likely less aggressive because they quarrel most often with the older children. It would be interesting to determine how these differences would change if the age groups were segregated. In that event the type of behavior would be more a function of individual personality than of age.

The percentages listed under *all ages* indicate that aggressiveness and retaliation are general characteristics of all quarrels, whereas objecting, undirected energy, and passive behavior characterize only a small percentage of them.

Motor activity during the quarrel. The percentage of quarrelers who display each type of motor activity appear in table 8. For the sake of brevity activities of infrequent occurrence, e.g. sticking out the tongue, are omitted here. At all ages pushing, striking and pulling are the most common motor activities. The older children exceed the younger in frequency of the more violent forms of activity; this agrees with the finding that the older children play a more aggressive rôle. The differences between the sexes in motor activity are not particularly striking. When young children quarrel, motor activity seems an almost inevitable accompaniment; in only three of the 200 quarrels is there no motor activity.

Vocal activity during the quarrel. In most of the quarrels comments were recorded verbatim. Vocal activity was classified as crying, forbidding and commanding, making factual comments ("you hurt me," "I had it first"), threatening, condoling ("I won't do it any more," "don't cry"), and calling names. The remarks were classified as reciprocal when one child answered the other, or as non-reciprocal when only one child talked or when the remarks were made independently (similar to Piaget's "collective monologue").

TABLE 9

Vocal activity exhibited by quarrelers

BY AGE	SILENT	CRIES	FORBIDS	THREATENS	FACTUAL COMMENTS	CONSOLES	CALLS NAMES	RECIPROCAL	NON-RECIPROCAL
54–65	33.3	9.1	39.3	13.6	16.6	3.0	4.5	18.1	43.9
42–53	36.7	27.1	24.6	4.2	17.5	0.6	0.6	16.8	23.4
30–41	49.6	30.6	23.3	0.6	2.4	0.0	0.6	5.5	19.6
18–29	63.2	32.6	2.0	0.0	2.0	0.0	0.0	0.0	4.0
All ages	43.8	26.3	23.8	3.8	10.1	0.6	1.1		
BY SEX									
Boys	45.7	20.2	28.0	4.4	9.2	1.1	1.1	11.4	25.4
Girls	41.0	35.8	17.3	2.8	11.5	0.0	1.1	10.4	19.1

The percentage of the 200 quarrels in which each type of vocal behavior occurred was computed. In 15 per cent of the quarrels no vocalizations at all occur; and in 77.5 per cent at least one of the participators is silent. Crying is the only behavior in 29.5 per cent of the quarrels; and crying on the part of one or more children occurs in 53.5 per cent of the quarrels. Threats occur in 7.5 per cent; forbidding and commanding in 43 per cent; comments of fact are made in 16 per cent; consolation is offered in 1.5 per cent; and names are called in 2 per cent of the quarrels. Thus, crying and forbidding and commanding are the most common types of vocal activity, while silence occurs more often than any single form of vocalization. Hall, too, found crying the most characteristic vocal response. The remarks are reciprocal in 11 per cent of the quarrels and non-reciprocal in 44.5 per cent. This points to the infrequent occurrence of the argumentative type of quarrel.

The percentage of quarrelers displaying each type of vocal activity is given in table 9. The same order of frequency holds as above.

Age and sex differences in vocal activity. Table 9 also presents the age and sex differences in vocal activity. Silence and crying decrease with age.

Non-reciprocal remarks exceed the reciprocal at all ages. Girls, in support of public opinion, exceed boys in crying; they also exceed the boys very *slightly* in number of factual comments.

It may well be that the frequency and duration of quarrels change with the type of quarrel. In the older children we see the beginnings of the argumentative type of quarrel so commonly observed in later childhood. Such lengthy arguments are undoubtedly responsible for the popular opinion that older children spend more time in fighting than they do in playing. These "quarrels" however are of a different type than the brief physical conflicts of the younger subjects.

TABLE 10

Outcome of the quarrels

	per cent
Child yields to force	47
Child yields voluntarily	10
Compromise	5.5
Child interferes	2
Teacher interferes	35.5

Outcome of quarrels. The percentage of quarrels settled by each of the various means is given in table 10.

Obviously the children settle the majority of the quarrels themselves, most often by one child's yielding to force on the part of another child; one is definitely the "victor."

Evidently the teachers supervise as closely outdoors as indoors, for they interfere outdoors in 35.2 per cent and indoors in 35.6 per cent of the quarrels.

Age and sex of those to whom children yield, compromise. Table 11 presents the age and sex of those to whom the child is forced to yield, to whom he yields voluntarily, and with whom he compromises, giving the percentage of each type according to age and sex. Most often, as we would expect, a younger child is forced to yield to an older child; and most often it is the older who voluntarily gives in to the younger. Only rarely does a younger force an older child to yield, and rarely does a younger child yield voluntarily to an older child. Sex differences are not striking. In each category the "Same Sex" heading leads, the result, no doubt of the fact that children quarrel more often with those of the same sex.

TABLE 11

Influence of differences in age and sex on outcome

	YOUNGER TO OLDER	SAME AGE TO SAME AGE	*OLDER TO YOUNGER*	SAME SEX	*OPPOSITE SEX*	*BOTH SEXES*
	per cent	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*
Yield to force	47.3	43.1	9.4	53.0	41	5.2
Yield issue voluntarily	15	35	50	50	45	5
Compromise	22.2	22.2	25.0 20.6*	60.6	18.5	14.8

* Ages combined.

After effects. Table 12 shows the percentage of quarrels after which the children are cheerful or resentful.

Evidently the children recover from

their quarrels very quickly for they are cheerful far more often than resentful *after quarreling. The sex differences* here are negligible. The studies of adults would indicate that they are more likely to have unfavorable after effects and that such reactions persist longer than is the case with these young children. Certainly the impression given is that the young child's emotions are quickly aroused and quickly dispelled.

THEORETICAL AND PRACTICAL IMPLICATIONS

The greater frequency of quarreling indoors in crowded playrooms suggests that the mother who wishes a peaceful household should encourage outdoor play whenever the weather permits, and should provide ample play space indoors.

TABLE 12

After effects

	ALL	BOYS	GIRLS
	per cent	*per cent*	*per cent*
Cheerful	76.5	77.4	75.1
Resentful	23.4	22.5	24.8

Quarrels are so short that the mother or teacher will find that the majority are settled before she has time to interfere. As our results show, might usually makes right at the preschool level, and to be sure, justice is not always done. Certainly one should interfere to protect the child from serious physical injury and probably to prevent too much domineering on the part of an older and stronger child. In general, however, it would seem wise to let children fight their own battles. The mother or teacher who continually interferes is depriving the *child of excellent opportunities to learn* social adjustment.

The tendency for quarreling to decrease with age is in line with studies showing that anger outbursts for adults are less frequent than in children. This difference may well be the result of social pressure; and certainly the type of quarreling differs, for adults use a variety of substitutes in place of the direct physical attack of the child.

The fact that children quarrel most often with those of the same sex is related to the findings of investigators such as Parten (21) and Challman (11) who found that children played most often with those of the same sex. That children seem to differentiate in regard to sex in their friendships as well as in their quarrels suggests a possible relation between friendship and enmity. The increase with age in quarrels arising over social adjustment is also in line with the increase in group play found by Challman, Parten and others. As social relations become more complex, difficulties of group adjustment increase.

Since the majority of quarrels start over possessions it is not surprising that the youngest children, who have not yet learned to share their toys, start the most quarrels. And though their resistance is less effective we see that even the youngest children almost invariably attempt to stand up for their rights. Of course the type of behavior displayed depends upon the immediate situation; a child may dominate one playmate and yet yield to another. For this reason it would seem wise not to segregate age groups too sharply, for the child needs practice in adjusting to a variety of social situations. Again, the parent who continually forces the older child to yield to the younger harms both. Likely as not the younger was at fault, and he too must learn to share, give and take.

The most striking thing about motor activity is that it is almost invariably present as the most prominant aspect of the quarrel. The brevity of the quarrel and the apparent lack of disagreeable after effects would indicate that the child "drains off" his anger through motor activity and gets it out of his system. In the adult who, let us presume, suppresses the more primitive impulses and substitutes vocal repartee, quarrels last longer and are more likely to have unfavorable after effects. In this study, the increase in reciprocal remarks among the older children is paralleled by increasing duration of quarrels. The efficacy of action in contrast to argumentation finds support here.

SUMMARY

1. The average duration of the quarrels, 23 *seconds, is surprisingly short. Quarrels of the older children* last longer than those of the younger. The brief duration of the quarrels seems a true characteristic and not a function of teacher interference, *although the teachers do terminate* quarrels indoors more quickly than quarrels outdoors.

2. Boys quarrel more frequently and are more aggressive during quarrels than girls.

3. Quarrelsomeness tends to decrease with age; at least quarrels of the type studied do.

4. The *youngest children start the* most quarrels but take the less aggressive rôle during the quarrel. As children grow older aggressiveness and retaliation increase.

5. A very slight negative relation is found between I.Q. and frequency of quarreling.

6. Children quarrel most often with those of the same sex, who are, however, either older or younger than themselves. The latter difference seems influenced by opportunity.

7. The majority of quarrels are started by a struggle for possessions. The number of quarrels of this type decreases with age but still holds the lead over other types at all ages.

8. Pushing, striking and pulling are the most common motor activities. The older children indulge in the more violent forms more often. In only 3 quarrels is there no motor activity.

9. Crying, forbidding and commanding are the most common forms of vocal activity, although silence is a more frequent reaction than any single activity. Talking during a quarrel increases with age but reciprocal conversation is rare. There is some indi*cation that quarrels of the argumentative* type increase with age.

10. The average number of quarrels per hour is three to four, although this is probably an underestimation of the total quarreling of this group. There *seem to be more quarrels indoors* when the children are crowded together.

11. The children settle the majority of the quarrels themselves, most frequently by one child's forcing another to yield. Most often the younger child is forced to yield to the older; and most often it is the older who yields voluntarily to the younger.

12. The great majority of the children recover after a quarrel very quickly and show no evidence of resentment.

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The Relation between Situation and Response in Vocalization of a Three Year Old Child[1]

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INTRODUCTION

THE purpose of the present study was to determine what effect, if any, the immediate environment has on the *quantity* of vocalization in a child. An effort was made to find out whether the average number of utterances per minute is relatively the same in all situations which are familiar to the child in which he is allowed to engage in free play or whether this amount differs from one situation to another.

In planning this experiment it was considered more worth while to make a thorough study of the conversation of one child rather than to take fewer records per subject on a large number of children.

Procedure

This study consisted of taking detailed records of the vocal sounds of one subject in different environmental situations. The five situations presented, all of which were familiar to the subject and relatively constant and in which the child was allowed to engage in free play, were as follows:

1. *In the home.* The subject had free access to play in any room of a six-room apartment all of which was located on the same floor. The parents of the child were usually in the apartment when the records were taken, but gave the subject no especial attention during the experimental periods.

2. *In the sandpile.* The sandpile was located out of doors and was comparatively isolated, being surrounded by a grove of trees on one side and a garage on the other. The street was not visible from its location. The subject had played alone in this sandpile at frequent intervals for twelve months prior to this experiment.

3. *In nursery school with children.* The subject had been enrolled in the nursery school for a period of four months when the experiment began. She was acquainted with each of the seven other children in the nursery. The children were of approximately the same age and had been enrolled for the same period of time. Play in the nursery school was restricted to one room. The school was furnished with the usual equipment. The children spent two morning hours in the nursery.

4. *In bath.* The subject was al-

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[1] The writer wishes to acknowledge her indebtedness to Dr. Wayne Dennis, under whose direction this research was performed.

lowed to play at home in the bath tub filled about one-third with water. She had been previously accustomed to playing in the water before being bathed.

5. *In the nursery alone.* The child was taken in the afternoons to the same nursery which she attended each morning, but she was alone in the play-room except for the experimenter.

For comparative purposes four additional situations in which the activities of the child were somewhat constrained were presented. Each of these situations presented some factor which might be expected to reduce the quantity of linguistic responses. These situations were as follows:

6. *Auto ride.* The subject was taken for rides in the country in the family automobile (a Terraplane roadster) driven by her father. The speed of the car was kept at approximately twenty miles per hour.

7. *Listening to music.* Music consisting of records of nursery rhymes was played on a victrola which was in the living-room of the child's home.

8. *Eating an ice-cream cone.* The subject was given a vanilla ice-cream cone to eat. The cone was always eaten in the living-room of her home.

9. *At a moving-picture show.* The child was taken to a theater which she had previously visited to see a movie, "State Fair," in which Will Rogers was starred. She had previously seen movies and had been trained to inhibit talking in this situation.

The movie record was a continuous two-hour record, divided into fifteen-minute intervals, but each of the other situations was presented for fifteen minutes, or only a fifteen minute record was taken at a time. Each sort of situation was presented ten times, two of a kind never being presented on the same day. Otherwise the situations were presented in a random order. Experimentation was begun at the same hour (4:00 P.M.) each day and on approximately seven days per week. In general, two situations per day were presented—the second being presented immediately following the first.[2]

The subject used in this experiment was an only child who had always been under the constant care of her parents. She had served as subject of a previous experiment and was, therefore, well acquainted with the experimenter when this study was made. The child was strong, robust and emotionally stable. According to the Stanford Revision of the Binet-Simon Test, her I. Q. was 156. The experiments were begun within one week after the subject had passed her third birthday.

In recording the vocalizations, all sense material was written down verbatim. The nonsense responses and "sing-song," which consisted of vocalizations uttered in a monotone, were indicated quantitatively, but no accurate phonetic record was attempted.

The experimenter did not talk to the child during an experimental period except when asked a direct question, and apparently the subject did not notice the fact that records were being taken.

RESULTS: TOTAL RESPONSES

The quantitative analysis of the records consisted of counting the total number of responses during each experimental period. In this count a response consisted of a meaningful word, an incomprehensible or nonsense word, or an accent or beat of "sing-song." No doubt personal interpretation of the experimenter entered somewhat into the recording and counting of these responses. There is, however, no reason to believe that the experimenter *recorded* differently in the different situations, so that differences or uniformities between the situations would be false. Following the usual procedure, contractions of the subject and verb were scored as two responses, whereas, contraction of the verb and negative, and hyphenated words were scored as one response. Table 1 shows the average number of linguistic responses for each experimental situation. The reliability of the differences in the average number of responses from situation to situation was then computed. $\frac{\text{D}}{\text{Sigma D}}$ for the average number of responses in the free-play situations are shown in table 2.

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[2] The time required for the performance of this experiment was approximately thirty minutes a day for seven weeks.

TABLE 1

	FREE-PLAY SITUATIONS					CONSTRAINED SITUATIONS			
	In the *home*	In the sand-pile	In the nursery with children	In *bath*	In nursery alone	Auto *ride*	Listening to music	Eating ice-*cream cone*	At a *movie*
Average number of linguistic responses...................	423.6	534.5	437.5	453.1	480.6	239.6	139.9	57	39

The tables show the following facts:

1. No reliable difference in the total amount of vocalization occurs between any two of the five free-play situations; namely, the home, sandpile, nursery with children, bath, and nursery alone.
2. The number of vocalizations in each of the four constrained situations was lower than in any of the five free-play situations. While no table of reliabilities for the constrained situations is presented, the figures were computed. The difference in quantity of vocalization between any one of the five free-play situations and the auto, music, ice-cream cone, or movie situation was found to be reliable.
3. A reliable difference in the quantity of vocalization was also found between any two of the four constrained situations, the order of the situations from highest to lowest number of vocalization being: (1) auto, (2) music, (3) ice-cream cone, (4) movie.

The fact that the differences in amount of vocalization in the five free-play situations were unreliable is of significance. The child was well adapted to the home, the sandpile, the nursery with children, the bath, and the nursery alone, each of which was a relatively stable situation. The quantity of vocalization had reached a constant level in these situations and showed no significant fluctuation from one experimental period to the next.

Thus the results obtained show that talkativeness was a constant trait in this child in these five familiar, stable environmental situations when the subject was allowed to engage in free-play. The results suggest that vocalization was highest in this sort of situation. At least, no situations which we presented resulted in higher records.

The fact that the quantity of vocalization was lower in the four constrained situations shows that the "normal" flow of vocalization may be inhibited probably by such factors as conflict of activity, unfamiliarity, quickly changing scenery, or by auditory stimuli such as the noise of an auto motor or music which must be "talked above" in order for the conversation to be heard. Such factors may explain the decrease in the amount of vocalization in the auto situation, the movie, the ice-cream cone, or while the subject was listening to music.

TABLE 2

$\frac{\text{D}}{\text{Sigma D}}$ *for the average number of responses in the free-play situations*

	IN THE HOME	IN THE SANDPILE	IN NURSERY WITH CHILDREN	IN NURSERY ALONE
In sandpile	2.55			
In nursery with children	0.30	2.51		
In bath	0.55	1.6	0.28	
In nursery alone	1.5	2.1	1.3	0.82

Thus the present data suggest the theory that all stable, familiar situations lead to the same quantity of vocalization, that no situations lead to a greater quantity than these, but that some situations do inhibit vocalization. Obviously this theory needs to be tested on a larger number of children in order to determine whether other subjects would tend to show the same characteristics. At present it is no doubt best merely to conclude that the vocalization of *some* children is in accord with the generalization stated above. In our opinion it is more important to know the detailed behavior of some concrete individuals than to know the average performance of many subjects, no one of which may conform to the averages derived from the whole group.

Results: Kinds of responses

In making a study of the records it was apparent that whereas the amount of vocalization is the same for all free-play situations, the type of conversation differs in the various situations.

It was therefore considered worth while to make a further analysis of these records in order to show that while the immediate environmental situation does not affect the total number of responses it does affect the frequency of some types of responses. An effort was made to devise some method of tabulating the responses which would show how the frequency of certain kinds of vocalizations differs from one situation to another.

This analysis of the records consisted of counting the following items:

(1) The number of times objects *present* in the immediate environmental situation were mentioned.

(2) The number of times objects *absent* from the immediate environment were mentioned. Absent objects were counted either as *remembered* objects or *anticipated* objects. *Memory* objects consisted of relating an event or mentioning an object with which the subject had experienced in

the past; for example, "I had a cake on my birthday." *Anticipation* included mention of any object or event to which the child looked forward; for example, "Where are we going to live in the summer?" In counting each of the first two items (present objects and absent objects) described above, the number of "times" a given kind of object was mentioned means the number of sentences in which such objects were mentioned. However, incomplete sentences were considered as well as completed ones.

(3) The number of proper nouns or personal pronouns which referred to imaginary playmates.

(4) Number of sentences addressed directly to a person present in the immediate experimental situation.

(5) The number of periods of "sing-song" responses which occurred. A period is a series of vocalizations in "sing-song" set off at either end by vocalizations not pronounced in a "sing-song" manner.

(6) The number of periods of nonsense which occurred. Here, as above, a period is a series of vocalizations in non-sense set off at either end by vocalizations not pronounced in nonsense.

In some cases a sentence was counted under more than one item. For example, "I will give this to Lucy when I go." In the preceding sentence "this" referred to a present object, "Lucy" referred to an imaginary play-mate, and "when I go" referred to anticipation. Thus the above sentence was counted separately under each of the three items (present objects, imaginary playmates, and anticipation). If the above sentence was addressed directly to a person present in the immediate environmental situation (a fact recorded in the records), it was also counted under item four.

The average number of times each item occurred in each of the situations studied was obtained, and this average is shown in table 3 below. The reliability of the differences in the average of each of these items from situation to situation was then computed. Table 4 shows these reliabilities expressed in

$$\frac{D}{\text{Sigma D}}.$$

The results show that while the situations did not differ in the total responses which they elicited, they did differ markedly in the frequency with which they called forth certain kinds of responses.

1. *Objects present* in the immediate environment were mentioned a reliably greater number of times when the subject played in the nursery with the other children present than when she played in the nursery alone.

2. *Remembered objects* played a reliably smaller part in the child's conversation while in the nursery with children than while playing at home or in the sandpile.

3. *Anticipation* was reliably greater in the home situation than in either the nursery with children, nursery alone, or bath situation.

4. *Mention of imaginary playmates* was reliably smaller when the subject played in the nursery with children than when she played at home, in the sandpile, or in the nursery alone.

5. *Sentences addressed* directly to a person "in the nursery with children" situation outnumbered those in each of the four remaining free-play situa-

TABLE 3

Average frequency of each type of response

AVERAGE	FREE-PLAY SITUATIONS					CONSTRAINED SITUATIONS			
	In the home	In the sandpile	In nursery with children	In bath	In nursery alone	Auto ride	Listening to music	Eating ice-cream cone	At a movie
Present objects	45.7	37.8	53.9	44.2	32.1	23.7	19.2	9.4	5.3
Absent objects:									
Memory	2.6	3.2	0.7	2	1.2	1.2	0.1	0.6	0
Anticipation	9	6.1	3.7	4.4	5.5	8	0.4	0.3	1.9
Imaginary playmates	11	14.1	0	15.3	13.7	0	0	0.1	0
Sentences addressed to person	16.5	3.5	56.6	49	4.9	1	27.6	10.4	0.3
Periods of sing-song	5.9	14.1	8.1	0.4	8.4	2.3	2.7	0	0
Periods of nonsense	4.1	13.4	7.3	7.5	8.6	2.2	0.3	0	0

TABLE 4

$\frac{\Delta}{\text{Sigma }\Delta}$ *for each type of response in free-play situations*

	PRESENT OBJECTS				REMEMBERED OBJECTS			
	In home	In sandpile	In nursery with children	In bath	In home	In sandpile	In nursery with children	In bath
In sandpile	1.7				0.61			
In nursery with children	1.6	4.4			3.00	3.07		
In bath	0.34	1.3	2.04		0.73	1.2	2.1	
In nursery alone	2.24	1.2	4.07	2.03	1.7	2.09	0.81	1.0
	ANTICIPATION				IMAGINARY PLAYMATES			
In sandpile	2.41				0.77			
In nursery with children	5.5	1.5			3.66	5.73		
In bath	6.5	1.5+	0.7		0.8	0.20	3.33	
In nursery alone	2.7	0.4	1.0	1.7	0.75	0	4.66	0.19
	SENTENCES ADRESSED DIRECTLY TO PERSON				PERIODS OF SING-SONG			
In sandpile	3.9				4.7			
In nursery with children	10.7	13.7			1.3	3.0		
In bath	4.0	0.31	14.4		2.4	2.89	0.63	
In nursery alone	7.1	1.2	18.6	2.0	1.4	3.46	0.17	0.71
	PERIODS OF NONSENSE							
In sandpile	5.73							
In nursery with children	1.91	2.75						
In bath	3.85	2.73	0.65					
In nursery alone	3.47	1.91	1.00	0.71				

tions, i.e. in home, in sandpile, in bath, and in nursery alone. Next in order (high-low) of number of sentences addressed directly to a person was the home situation. The sentences directly addressed to a person in the home situation were reliably higher than those in the sandpile, nursery alone, or bath situations, and reliably lower than "in the nursery with children."

6. *Periods of sing-song* in the sandpile situation were reliably greater than in any of the other free-play situations.

7. *Periods of non-sense* in the home situation were reliably lower than in the sandpile, nursery alone, or bath situation. Periods of non-sense in the sandpile situation were reliably greater than in the home, in nursery with children, or in the bath situation.

Tables for the constrained situations are not presented to show the reliability of the differences in frequency of *types* of responses, but it is obvious that in these situations as in the free-play situations the kinds of vocalization differ in frequency from one situation to another.

SUMMARY

Vocalizations of one three-year-old child were studied in five stable and familiar free-play situations and in four situations which might be expected to restrain the use of language.

The study showed that the average number of vocalizations per fifteen minute period—in which comprehensible, incomprehensible, and nonsense words, and "accents" in sing-song were counted as units of vocalization—did not differ between any two free-play situations. The kind of free-play situation did not affect the total output of vocal utterances.

However, the sort of responses which made up the total vocalizations varied markedly from one free-play situation to another.

The constrained situations reduced the amount of vocalization as was expected. These situations also differed among themselves in the absolute and relative frequency of different types of vocalization by the child.

Attitudes of Children Toward Their Own Bodies and Those of Other Children

MIRIAM S. DILLON

THE purpose of this study was to ascertain the attitudes of young children of both sexes toward their own bodies when undressed, and toward those of other children.

Two groups of nursery school children were used for observation. Group 1 consisted of 11 boys and 11 girls, whose mean age was 34.7 months with a range from twenty-seven months to forty-two months. The mean intelligence quotient was 117.8 with a range from ninety-nine to one hundred thirty-five. Group 2 consisted of 8 boys and 8 girls, from forty-two to sixty-two months in age, with a mean age of fifty-one months. The mean intelligence quotient of this group was 126.5 with a range from one hundred eight to one hundred forty-seven. The children of the two groups did not mingle with each other freely. They ate and slept on different floors of the same building, and special parts of the playground were assigned to each group. However, reasonable freedom was permitted the children to go from one group to another, especially on the playground. All the children ate their midday meal and took their afternoon sleep in the school. They undressed completely, and put on their pajamas for the nap. The dressing room for the younger group contained not only the children's lockers, but also the wash basins and the toilets. The toilet and wash basins for the older group were in a bathroom adjoining the dressing room. There was no segregation of the sexes in either group. One adult was in charge of each dressing room and on some occasions there was an assistant. Adult observers were so common among the children during all their activities that they created no unusual situation.

Twenty-one observations on consecutive school days were made of each group during the dressing period, either before or following the afternoon sleep. The observation periods averaged twenty-five minutes.

The following behavior was recorded: manipulation of the genitals; interest in the different parts of the body other than manipulation of the genitals; interest in elimination; interest in the facts of sex differentiation; language used for elimination and parts of the body; use of tabood language which involved elimination or the genitals; and demonstration of affection.

MANIPULATION OF THE GENITAL

In the younger group there were 14 instances of play with the genitals in some form. Four children were responsible for one instance each; two boys for 2 instances each; and one boy was responsible for 4 instances. Whenever the behavior was noted by the teacher, the child's attention was diverted to some other activity without reference to his behavior. The diversion always appeared to be natural and unaccented. Four cases appeared to be motivated by curiosity about the structure of the organs. For example, John had finished urinating, but a few last drops continued to form. He bent over to watch these, and appeared to be interested in the opening of the urethra. He pulled back the foreskin, watched the last drop appear and fall, was apparently satisfied, so flushed the toilet and returned to his task of getting dressed. In 4 cases the behavior was momentary and appeared to be absent-minded, like the habitual biting of nails, or pulling at the lips, with no evidence of a conscious sensory response. In 4 instances the behavior, although of an absent-minded character, was prolonged. In these cases, the children were exceedingly unstable and the tic-like manipulation of the genitals accompanied crying, refusals to comply, interference with the activities of other children, and failure to persist in the task of dressing.

In the older group there were 20 cases of play with the genitals in some form. Six children were responsible for 1 instance each; 3 instances were observed for one girl, and 11 for one boy. There were 7 cases in which the manipulation was prolonged, 5 of which involved the same boy. In no case did the manipulation appear to be motivated by curiosity about the nature of the organs. In 18 cases, the manipulation appeared to be mechanical, like the activity of a tic.

An illustration of an habitual interest in play with the genitals is seen in the case of the girl. During the 21 observation periods she was observed handling her genitals on 3 occasions. On 2 of these occasions she appeared to be fully aware of what she was doing, and in one instance she seemed to obtain some sensory response. The child was sitting on the floor preparing to put on her union suits. Her knees were drawn up and apart and the vagina opening was exposed. Her face carried a dreamy, far-away look. She absent-mindedly picked up her shirt and in doing so the draw string chanced to pass over the vulva. Her attention at once became centered, she half smiled, and continued to pass the string slowly back and forth over the vulva. There was no effort to conceal the act, nor was the attention attracted of any of the other children who were dressing in the same room. The teacher diverted the child's attention by picking up her underwear, handing it to her, and saying, "See, the others are nearly ready to go out to play. You will have to hurry to catch up with them." Her attention was diverted immediately. There was no evidence of a sense of shame or guilt. However, she required continuous reminding in order to finish her dressing. It was reported later by the mother that this child was an habitual masturbator. Her general behavior in the school was unstable. She interfered with the activities of other children, had a short span of attention and dawdled over all routine procedures, including her eating.

One boy, 4 years old, was observed masturbating on 11 of the 21 observation periods. The play or manipulation appeared to be a means for the release of tension. It ceased at once when the attention became centered on any definite activity. The penis was frequently erected, and the manipulation often consisted of drawing out the foreskin. On one occasion another boy observed him and remonstrated with him saying, "You will make yourself sore down there."

The manipulation of the genitals was not stimulated necessarily by nakedness, the presence of both sexes, or elimination. Rather, it seemed to be related to a state of emotional instability. The activity usually was not accompanied by a conscious sensory response apparently, but was a mechanical, motor reaction which served, perhaps, as a release of tension. Masturbation was much more frequent among the boys than the girls. This is to be expected because of the accessibility of the penis. In no case was there an attempt to conceal the play nor was there any indication of a sense of guilt or shame. When the manipulation was observed by the teachers they manifested no disturbance, but attempted to center the child's attention in a definite task or play.

Interest in parts of the body

A list also was made of incidents other than manipulation of the genitals in which a child manifested an interest in his own body or that of another child. Such behavior as examination of the navel, eyes, hair, or anus, was recorded; also stroking of the skin; calling the attention of other children to his body, or observation of himself in the mirror. The ordinary, necessary routine activities required in washing the hands and face were not recorded.

Sixteen observations were recorded for the younger children. Four of these concerned one girl who had the habit of gently stroking the skin under the arms and over the ribs during periods when her attention was not actively engaged. Two similar instances were observed in the case of another girl. The navel interested one child on 2 occasions. She poked and pulled at it and made it go in and out by contracting and expanding the abdominal muscles. One boy was interested in his anus. The same child on another occasion joked about his buttocks in a way which indicated conditioning through contacts with children outside the nursery school. It was the commonplace occurrence of turning his back to another child, protruding the buttocks, and laughingly remarking, "Kick me *here*." Both children laughed and the incident was closed as other interests attracted their attention.

Another child exhibited a peculiar interest in her breasts. She was a rather listless child, under-weight from a serious illness, and always appeared drowsy during the preparations for the afternoon sleep. When sitting on the toilet during these periods she often sucked her thumb. At other times she wadded up pieces of toilet paper into soft balls, and placed one over each breast under her shirt, then patted them gently. She would remove them, then replace them several times, always patting them gently. They remained in place during the nap.

Two boys showed in interest in the penis as in the following incident: Bob sat upon the toilet for the purpose of evacuation. His knees were apart and his penis was conspicous. Tom approached, noticed the penis and began to poke it. Bob laughed, and both children appeared to be amused watching it go up and down. "See your automobile!" said Tom. The activity was not concealed. The teacher diverted their attention to other interests. This interest, however, was not eliminated. Bob returned to the toilet and when it was suggested that he had sat there long enough he replied, "No, I want to make another automobile."

The behavior of most of the children during elimination was a matter-of-fact as brushing the hair. This is illustrated by the incident of Robert who came into the dressing room to urinate. Katherine was sitting on the toilet next to him. She evacuated, left the toilet, and joined a group of children at the window. Robert, flushing his own toilet, observed that Katherine had not flushed hers. Immediately he went over to her. "Have you finished?" he asked. "Come, then, and flush your toilet; then take some toilet paper and clean yourself off." Katherine complied, and when she had completed the routine, he departed, apparently satisfied.

Only one instance occurred which indicated that a child had been conditioned to regard elimination as a tabood subject. Joe approached the teacher hurriedly, and drawing her head down close to his, he whispered. "B. M." This was the same child who had joked about his buttocks and had manifested a somewhat furtive interest in his anus.

One incident occurred which showed the contrast between the procedure maintained by the nursery school, and that still practiced in some families. John had been enrolled recently and was having difficulty in adjusting. Therefore his mother remained with him during the preparations for sleep. He timidly approached a toilet to urinate, closely followed by the mother who stood beside him, spreading her skirts between him and the little girl seated on the next toilet. "Hide the little boy! Let's hide the little boy!" she whispered audibly.

The beginning of a furtive or tabood interest was observed in a form of play which the children developed. At various times a child's rectal temperature had been taken by one of the teachers. Some of the children began to imitate the performance in their play. A slender cylindrical block about three inches long was often used as a thermometer which they pretended to insert in the rectum. Sometimes one child undressed another but ordinarily this was not attempted. When the play first appeared the director of the nursery school tried to discourage it, with the result that the children withdrew to secluded places and continued it with increased interest. Therefore, she changed her method and suggested that they play in the customary situations. The children complied. The interest in the game continued spasmodically for five weeks and finally disappeared without any special interference. During this period only one instance was observed of an attempt to hide the play. In all other cases the play was not affected by the presence of adults. Although this game spread to many of group 1 there were three older children who exhibited a more sustained interest than any of the others. Three instances were recorded in the dressing room during the observation periods which were related directly to this game. Ted brought a three inch nail into the room which he exhibited while undressing. Jane looked at it and immediately requested the teacher to take her temperature. "Are you sick, Jane?" Miss Ward asked.

Jane dropped her eyes an instant and replied, "Ye-s," rather slowly, then quickly shook her head, laughed, and said emphatically, "No!"

On another occasion, Miss Ward sat down on a chair in the dressing room with Hester in her lap and took the child's temperature. At first four children were interested in the procedure but they soon returned to their individual tasks. Martin, however, placed a little chair immediately next, where he could see. He peered into the thermometer and the child's anus, patted her buttocks gently, smiled at Miss Ward, and then sat contentedly observing and patting until the time was up. As Miss Ward left the room, he ran along behind her, saying, "Take my temperature, take my temperature, Miss Ward."

The interest which the children of the younger group displayed in this game appeared quite out of harmony with their other behavior toward the organs of elimination. The simplest explanation of their interest might be found in the first responses of the adults when the play appeared. Probably every adult who witnessed it experienced a feeling of revulsion toward it, whether consciously expressed or not. Such reactions seldom are completely repressed and therefore the emotional quality may have been transferred to the children at the beginning. In any event, the early discouraging of the game increased its fascination. It lost its attractiveness when brought out into the open and the staff became schooled in reacting to it as towards other play. Whatever the explanation, the incident is significant because it demonstrated the ease and rapidity with which the excretory organs can take on a tabood lure, even at so early an age as three or younger; this, despite the routine of the dressing room periods, and the special training of the teachers. It was noticed, too, that the children who participated most frequently were the older ones of the group—that is, approximately three years of age.

The most noticeable behavior of the children of group 2 when undressed in the presence of other children or adults, was an absence of any sense of impropriety. The following is a typical illustration of their behavior:

Tom, age fifty-one months, had been sent upstairs to the dressing room from the playground to put on his sun suit. After removing his clothes, he found his sun suit so twisted that he was unable to straighten it out. As there was no one to assist him he ran down the stairs, among visitors, past the groups of children standing in the halls, out the front door and on to the play ground, waving the suit above his head. The teacher helped him solve his problem and his lack of clothes interested no one.

Seventeen observations were made

of a direct interest either in their own bodies or those of other children in this older group. This interest was different from that shown by the younger group. These children apparently were aware of what they were doing and frequently called the attention of other children to their behavior. In some cases the children seemed to present the same unemotional attitude toward one part of their body as another. For example Mildred stood beside the toilet while Ted was urinating. "What is that?" she asked.

"That is my penis."

"Girls do not have a penis," she remarked, looking up to the teacher for confirmation of her statement.

"That's right, Mildred," replied the teacher, "Only boys and men are made that way."

"And my Daddy, too," the child added. The tone of the conversation was exactly the same as if it concerned hats or spectacles.

One of the children exhibited a slight rash, so the teacher said, "Come, Helen let's take your temperature." As they left the room, Anne remarked, "You can put the thermometer in the mouth, in the anus, or under the arm." All three words were used in precisely the same tone of voice.

Frederick, Alicia, and Jane were awaiting their turn at the basin. Alicia pointed to Jane's breasts. "Do you know what this is? That means you have milk in your two little things. That's what happens when you have a baby."

Frederick added his bit, "Yes, that's for a baby."

On the other hand, there were occasions when a child would strut around the room, with his abdomen protruding, slapping himself, and calling out, "See my big fat tummy!" Often the performance was taken up by other children. Sometimes the child enjoyed watching the effect in the mirror. They laughed, rolled their eyes mischievously and poked at each other. There was no attempt to hide the activity, and the teachers did not interfere except to call attention to the task of dressing. Such performances were engaged in by the children whose attention seemed easily scattered, who interfered with the persistence of other children, and who required the greatest amount of assistance in completing their routine tasks.

There was but one incident in which a child appeared to be aware of the conventional impropriety of appearing undressed before strangers. This was Nan who came from a family in which there were 4 children, 2 of whom were boys. She had attended the nursery school for two years. On this occasion there were boys and girls and 2 adults in the dressing room, all engaged in the customary routine. Nan dropped off her pajamas and walked about the room talking to one child then another. Realizing that she was slower than the others in dressing, she hurried over to her clothes which hung on hooks next to the open door leading into the hall. One of the teachers of the younger group stopped at the door to say something to the teacher in charge. Nan became much agitated, grasped her clothes about her and cried out, "Go out, go on *out*, don't you see I'm naked?" The teacher, who was in a hurry, passed on, apparently not aware of the flurry she has caused. Nan proceeded with her dressing without further comment. Her behavior appeared to be more a matter of imitation than a symptom of shame. However, this incident is one of many which illustrated how the children of this group were conditioned to conventional behavior through prevailing social attitudes and practices at home without being aware of the meaning of such customs.

The following behavior suggested an incipient sadistic trend, or a satisfaction of a disagreeable emotion through the contemplated infliction of bodily pain. Julia had created so much disturbance in the sleeping room that Miss Marsh required her to sleep apart from the others. The child retained a grudge against Miss Marsh during the subsequent dressing period when she related in detail all the things she expected to do to Miss Marsh. "I'll beat her *here* (anus), and *here* (abdomen), all naked." The other children took up the theme and vied with each other in the tortures to be meted out on the body of the poor teacher. The attention of the group was diverted to other interests, but Julia's thoughts evidently reverted from time to time to her original grudge, for she repeatedly uttered threats of the punishment to be imposed on the naked body of Miss Marsh.

Two occasions were observed in which two children of opposite sex appeared to show special sex interest in each other. One of these was as follows:

When the observer entered the dressing room most of the children were grouped about the teacher who was talking with them, and the others were engaged in dressing. Sue stood in the middle of the room, abdomen protruding. George stood opposite with abdomen out and penis erected. Both children were looking intently at each other. Sue's interest was diverted by the entrance of the observer. She left George, came to the observer and started a conversation with no evidence of self-consciousness or shame. George followed, clutching nervously at his genitals. The observer presented a negative attitude to Sue who turned away and joined the group around the teacher with her back to George who followed her persistently. His abdomen was still extended, he held his penis with both hands, with which he touched Sue's buttocks. Sue turned around, looked at him impatiently and showed no interest. "Bring your 'tee-tee'," he said, to which Sue replied, frowning, "No, no!" Apparently she was interested in the conversation of the group, and was annoyed by his interruptions. He left, still holding and pulling at his penis. He turned to another girl and said, "Look!" At this point Miss Marsh called his attention to his dressing. The child was exceedingly unstable during the entire period. He interfered with others, dawdled, and when not occupied, manipulated his penis. He did not comply with Miss Marsh's suggestions and remained undressed at the close of the observation period.

An occasion of sex interest was observed by one of the teachers during the noon meal. This was a surreptitious examination of the genitals by a girl and a boy, both fully dressed; this, despite the fact that they customarily undressed completely in the same room, and played around together for fifteen minutes or longer before or after the sleep period. It is apparent that some special interest may become associated with the genitals at an early age which has nothing whatever to do with curiosity about their physical appearance.

The game of taking the temperature through the rectum was acquired from the children of the younger group. There was a distinct difference in the attitude toward this play from that which was observed among the younger children. Apparently the play involved a set taboo, for it was never done openly, but always in secluded places and ceased as soon as the children became aware of the presence of an adult. The interest did not fade out as it had among the younger children. The reaction of these children to this game is significant. As a game it was too stupid to satisfy even the younger children after the element of taboo was removed. To the more mature children the fascination must have been due to a more fixed and mysterious taboo.

In general, it is obvious that the children of this group had developed a much more definite awareness of their bodies than the younger children, although with one exception, they gave no evidence of an attitude of impropriety in appearing undressed before anyone at any time. Occasions of sex play between children of opposite sex were very infrequent, yet the fact that they occurred at all is noteworthy. It is apparent that the satisfaction of curiosity alone does not necessarily prevent these incidents.

Sex differentiation. In the classification of sex differentiation was included all incidents in which the children showed an interest in the characteristics which distinguish the sexes, either through their behavior or language. Among the younger group of children there appeared very little evidence of any recognition of such differences. Probably the differences between boys and girls were no more conspicuous to them than individual differences among girls or among boys. This was indicated by the use of the phrase "bad boy," which was applied as a term of opprobrium indiscriminately to both sexes.

Among the children of group 2 there was no misapplication of the words boy and girl. They manifested their consciousness of sex difference chiefly by differences in clothing and customs. As shown previously, some children recognized a physical difference. However, the male organ was not taken generally as one of the essential distinguishing characteristics, but as an incidental possession which girls did not happen to have. One child, Lucy, appeared to have sensed the fundamental anatomical facts of difference. The following conversation occurred between Lucy and Grace:

Lucy, "You're not a boy."

Grace, "Yes, I *am.*"

Lucy, "No, you're *not* a boy."

Grace, "At *home* I am."

Lucy, "No, you can't be, *ever.*"

Grace, insistently, "Yes, I am too, at home."

Lucy, "How *can* you be a boy?"

Grace, triumphantly, "'Cause I wear boys' clothes!"

Lucy, puzzled, "That's a funny way." Lucy appeared dissatisfied with the explanation, and obviously would have protested further, but the attention of both children was diverted. On investigating the subject with the mothers it was found that Lucy had received very definite sex education from the time of her first questions in which the essentials of sex differences had been made clear, apparently. Grace's sex education had been vague. She admired greatly boyish achievements and at home always dressed in boys' clothes.

Such remarks as, "Merle's a name for a girl." "Boys wear ties, and girls do not." "Boys have short hair," were commonly heard.

One child, evidently, had received some information about nipples being a characteristic of the female as indicated in the following incident:

Babs had drawn a profile picture of a dog, standing on its hind legs. She pointed to a row of large dots which she had placed conspicuously, and said, "Those are its buttons." Miss Blair asked, "Oh, he has on a coat?" And Babs replied, "No, he is a *girl* dog." She had used the word buttons to signify nipples.

Among the younger group unconcealed attempts were observed for the girls to imitate the boys' method of urinating. No such attempts were noticed among the girls of group 2 during the observation periods. One incident was reported, however, at another period. Three girls who thought they were not observed were discussing the subject. The oldest pretended, but another child actually attempted to use the the toilet standing up in front of it. Naturally she wet her clothing which necessitated the aid of the teacher and general embarrassment resulted among the group. On another occasion one of these girls was noticed strutting around the playground with a hose between her legs "showing off" before the other children. The emotional tone that accompanied these incidents was quite different from that of the younger girls who tried to imitate the boys.

Tabooed language. Recording was made of all language which the children used which manifested tabooed attitudes. The following behavior characteristics were considered evidence of such attitudes:

1. The child "snickers."
2. The child attempts to conceal his language or behavior.
3. Behavior ceases when an adult appears.
4. Child characterizes the language as "bad words."

Among the younger children there was only one instance in which a child showed any such evidence. This was the incident previously related in which a child whispered to the teacher his need for having a "B. M."

The use of tabooed language or "sensitized" words had appeared unmistakably among children of group 2. The language usually referred to elimination in some form and was characterized by the children as "bad words." Eight incidents were recorded during the 21 observation periods and each incident involved 2 or more children. When the incidents were noticed by the teacher she ignored them. If they did not cease naturally she diverted the children's attention to other interests. No comment was ever made about the language. The following incident was typical:

Mack sat on the floor putting on his pajamas in a dreamy, dawdling manner. Suddenly he said out loud to no one in particular, "Hello, B. M.!" "Hello, B. M.!" He repeated the phrase with increasing animation, got up from the floor, crossed the room and approached Bert who was undressing. They whispered and giggled together and Mack admonished, "Don't you tell!" Bert then burst forth, "Hello, big pee-pee! Hello, big pee-pee!" Mack whispered again to Bert, laughed, protruded his abdomen and penis saying, "ss-ss-ss." The incident was dropped suddenly by an interest in another child's activity. Mack put on his pajamas and left the room. Bert continued to undress, absently talking to himself, "Mack, B. M. —— B. M. —— Mack." Then he quickly turned to Margy who stood about three feet distant: "Hello, Mrs. B. M." and laughed. Margy repeated, "B. M., B. M." and giggled. Immediately the others in the group repeated the expression like a refrain until diverted by Miss Marsh.

Another incident started a whole train of snickers, giggles and "don't tells." Janet had left the dressing room and Edna asked: "Where did Janet go?"

Miss Marsh replied, "She went to the toilet. She will be back in a moment."

After this commonplace comment Edna put her hand over her mouth, shook her head, and said, "Miss Marsh said a bad word, a bad, *bad* word."

"What did she say?" asked Anne.

"Come here and I will tell you." And there followed much suppressed whispering. The bad word it was found was toilet and was sufficient to start some sort of tabooed associations in the thoughts of this child who passed them along to the others.

Terms used for elimination and the genitals. Among the younger children a variety of family or baby terms was used openly and without self-consciousness for urination. The penis also was referred to by the use of baby terms. "B. M." was used four times for evacuation.

In the older group the children were entirely self-sufficient in the matter of elimination so that no use of any terminology seemed necessary. Penis was used twice, anus once, and breasts twice. These terms were used in the course of ordinary conversation and without emotional significance.

It was found that some of the parents had taught their children accurate terms for elimination and the genitals. However, they stated that baby terms were soon acquired from the other children and used in preference.

Behavior of teachers. All incidents of a sex nature were ignored purposely by the teachers unless the behavior was prolonged, in which case the attention of the children was diverted to other interests in a way which seemed natural and called no attention to the particular behavior. The conditioning was passive or negative in the sense that the behavior of the children called forth no overt opposition or rebuke. With respect to the language used by the children the behavior of the teachers was likewise negative.

All "sensitized" or tabooed words were ignored. Although the teachers never used baby terms for elimination they seldom used specific or accurate terms. For example, a child was told to go to the toilet when he was expected to urinate. The abbreviation, "B. M." was always used in place of the full words. However, the manner and tone of voice used by the teachers were always matter-of-fact, or like those employed towards other activities of the children. Likewise, the teachers did not use baby terms for the organs of elimination or the genitals. However, no instance was observed at any time of any teacher ever mentioning the genitals by name in the presence of the children. This statement covers not only the periods of observation during this particular study but also includes a period of two years contact with the nursery school. The children were told "to clean themselves off" after evacuation, or to "dry themselves" after urinating. On the other hand, teachers were careful to state specifically when other parts of the body were concerned, "Wash your *hands*," or "Dry your *face*."

CONCLUSIONS

From the observations made in this study the following conclusions are indicated:

The predominant attitude of children under three-and-one-half years when undressed toward their own bodies and those of other children of both sexes is the same as when dressed. However, the exceptional cases were sufficient to show that simply because a child is three-and-one-half or less he is not necessarily without emotional attitudes toward his body.

Among the children of three-and-one-half to five there was, in general, no sense of impropriety in appearing undressed, but there was a more definite awareness and interest in their bodies than in the younger group. This awareness was shown by their comments and questions about various parts of the body and by some tendencies toward exhibitionism.

Manipulation of the genitals appeared to some extent in both groups, the nature of which seemed to be an unconscious motor activity like that of a tic. No sensory satisfaction such as is characteristic of masturbation was evident except in one case. There was no effort to conceal the activity nor any manifestation of a sense of shame. The manipulation appeared most frequently during periods of inattention and emotional instability.

In general, the younger group did not differentiate between the sexes. The expression "bad boy" was applied as a term of approbrium indiscriminately to either sex.

Differences in the appearance of the genitals were observed apparently by some of the children of the younger group, but such differences did not carry a sex significance; rather, they appeared like individual differences of eye color or hair.

The children of the older group recognized anatomical differences between boys and girls. However, they did not recognize the determinative quality of such differences, but regarded them as incidental characteristics. Even in this group distinctions between boys and girls were made primarily on the basis of differences in styles of clothing, manner of wearing the hair and the names which the children bore.

Among the younger children elimination appeared to involve no taboo. Usually, the activity stimulated no notice.

The use of "sensitized" words appeared unmistakably among the children of the older group. These words were concerned usually with elimination in some form.

Beginnings of a fixed tabooed interest in the genitals were manifested among the older group through the tendencies to conceal their use of sensitized phrases, the concealed efforts of some girls to imitate the boys in urination, and the furtive interest in the game of taking the rectal temperature.

The exceedingly infrequent cases of sex play between children of the opposite sex which occurred were found only among the children of the older group. However, the fact that they occurred at all indicates that such play is not always motivated only by curiosity about the appearance of the genitals of the opposite sex.

The terminology used by the children for elimination and the genitals rarely included specific, scientific terms.

The behavior of the teachers on occasions of undesirable sex behavior of the children was either an ignoring of the incidents or a diverting of the children's attention to other interests. Their behavior toward elimination was matter-of-fact as in all routine procedures.

Although the teachers never employed baby terms for elimination they did not use specific terms. The genitals were not spoken of at all.

The Influence of the Environment Upon Health and Function*

MAX SEHAM AND OLE SCHEY

THAT health habits physical and mental produce marked and at times permanent disturbances in the biological fitness of the child is commonly believed but verifiable evidence to that effect either experimental or clinical is scarce in the medical and psychological literature. The literature on this subject is rich in quantity but poor in quality. It consists chiefly of "addresses," based upon half truths and clever slogans, and of medical case reports, presented as illustrations to prove a point.

The present investigation[1] was made for the purpose of finding out how school children live and what effect environmental factors have upon their physical and physiological well being.

When, in 1927 this study was begun, it was hoped that it would lead to a precise and verifiable answer to the question: *What effect has the environment upon the health of the individual child?* Theoretically speaking a specific answer to this question should be possible. If we knew the inherent nature of man, by careful observations and by the use of reliable tests we should be able to establish and even to measure the effects such influences as sleep, food, and other health habits have on the organism. However, with the limited methods of functional diagnosis at our disposal this is practically impossible. The situation includes a large variety of causal influences including individual differences, age, mentality, temperament and other associated factors. It is for these reasons that we have especially tried in this paper to avoid the fallacy of considering association and causation as synonymous. In presenting the following data it is at no time claimed, not even in the most constant and most significant associations and relationships, that these conditions are dependent upon one another or are caused by one another.

In this article we have attempted to study by the questionnaire method: (1) The percentage incidence of health habits, (2) the relation between health

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habits and functional disorders, (3) the relation between one health habit and another, (4) the percentage incidence of functional disorders and (5) the relation between one functional disorder and another.

Two hundred sixty-two children were studied. Seventy-one children were between the ages of eight to eleven years, and one hundred ninety-one between the ages of twelve to fifteen. The younger children were a mixed group of white and colored attending school in a poor district, the older children came of somewhat better-to-do parents attending Junior High Schools in two different locations.

A QUANTITATIVE ANALYSIS OF HEALTH HABITS

Sleep. The average child sleeps about ten hours a day. He occupies a room with some other member of the family, usually a brother or sister. He frequently keeps his window open, and awakens at least once during the night to go to the bathroom. According to the standard schedule 42 per cent of the children have an inadequate amount of sleep. The children who went to sleep early (according to this schedule) fell asleep quickly, in fifteen to thirty minutes, whereas those who had insufficient sleep took much longer to fall asleep, some as long as one hour. (This fact was obtained from the mother.)

The time for going to bed varied on an average about 40 minutes between the two groups of children. The range for the younger children being from seven and one-half hours to twelve hours and for the older children from seven to eleven hours. The actual mean for the former is 10 hours and for the latter 9.3 hours. This means that the child of from eight to ten years of this particular group retires at about 9 and arises at about 7, the older child retiring close to 10 o'clock and arising at about 7 in the morning.

Dietaries. The analysis of the dietaries by means of the questionnaire reveals not the quantity but merely what kind of food a child eats. In general one may say that the average diet of these children is one sided in quality depending upon the racial customs and habits. The diet of the Jewish child is characterized by an excessive amount of fat, improperly cooked vegetables, spicy foods such as smoked corned beef and tongue, herring, smoked fish and sardines. The Italian child eats a highly spiced diet with over emphasis upon the carbohydrates. The colored child is notoriously irregular in his food habits, going on eating sprees between meals and late at night. The dietary of the native American child is more properly balanced although deficient in the variety of vegetables.

Perhaps the following general criticism may be made of the diets as reported by the children, (1) One sided and monotonous, (2) vegetables, insufficient in amount and variety, (3) too many condiments and spurious foods.

Quantitative studies were made of the amount of candy, coffee, and milk consumed.

Candy. There is apparently very little difference in the average amount of candy eaten between the younger and the older children, the average being 2.6 and 2 pieces respectively. Except for 10 per cent of the older children candy is eaten regularly every day by all of them.

Coffee. About one half of the younger children drink coffee daily, the average of the total group being one half of a cup a day, slightly higher for the older children (.67 of a cup). Fifty-eight per cent of the older children drink no coffee at all.

Milk. The younger children drink on an average more milk than the older, 3 against to 2.4 cups. Forty per cent of the younger and 25 per cent of the older drink daily one quart or more, 87 per cent and 70 per cent respectively drink one pint or more. Five per cent of the former and 11 per cent of the latter do not drink milk.

TABLE 1

A quantitative study of the health habits of 65 younger and 191 older children

	SLEEP			CANDY			COFFEE			MILK			PLAY						HOME STUDY			CLUBS			MUSICAL INSTRUMENTS			MOVIES			RADIO			PARTIES			CHORES		
	Number of hours			Number of pieces			Number of cups			Number of glasses			Number of minutes						Number of minutes			Number per week			Daily practise			Times per week			Minutes per day			Number per month			Number of minutes		
													Outdoor			Indoor																							
	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.
Younger*	10	7.5	12	2.6	0	6	.5	0	3	3	0	5	151	0	240	104	0	240	59	0	135	1.1	0	4	17	0	180	1.3	0	3	45	0	240	.6	0	4	30	0	90
Older	9.3	7	11	2	0	10	.67	0	5	2.4	0	8	168	0	240	70	0	240	40	0	240	.6	0	7	18	0	120	1.2	0	7	70	0	300	.6	0	4	44	0	210

* Younger = 8-11 years; older = 12-16 years.

Play. A quantitative study of play is somewhat difficult to make. Notwithstanding the fact that the answers bearing on this subject gave a low similarity score, the general information obtained may be of value. The average amount of play after school is 2 hours and 31 minutes for the younger and 2 hours and 48 minutes for the older children. The girls between the ages of eight and eleven play as much as the boys of the same age, but the older girls play less than their male contemporaries. The average indoor play of the younger child is 1 hour and 44 minutes and that of the older child is 1 hour and 10 minutes.

Home study. The girls average more home study than the boys at all ages.

Musical instruments. Eighty per cent of the younger and 67 per cent of the older children receive no musical instructions nor own a musical instrument. The remaining 20 per cent and 33 per cent respectively spend between seventeen and eighteen minutes in daily practice. The maximum time spent by both groups is practically the same.

Social activity. The average attendance of evening performances at motion picture theatres is about the same in both groups—usually one evening a week. However, the maximum number of visits is much higher for the older than the younger child, 7 times as compared to 3 times a week. Sixteen per cent of the former and 50 per cent of the latter never attend movies in the evening. The radio has substituted somewhat for the movie in entertainment. The younger children spend on an average 45 minutes a day listening to the radio whereas the older children average about 70 minutes. Forty per cent of the former do not listen to the radio at all against 27 per cent of the latter. Apparently going to parties does not play very much of a rôle in the child's life. The average number of evening parties for all children is about the same, less than one party a month.

Clubs. The data collected show that the younger children spend more time than the older attending club meetings. This may be due to the fact that the former live in a district where social settlements are many and where children are wont to spend a great deal of their time.

TABLE 2

A comparison of the percentage incidence of health habits in younger and older children

AGE	SEX	NUMBER OF CASES	ADEQUATE SCHEDULE	INADEQUATE SLEEP	INADEQUATE FOOD	EXCESSIVE PLAY	EXCESSIVE HOME STUDY	EXCESSIVE SOCIAL ACTIVITY	WORK FOR PAY
years 8–11	M. F.	34 30	12	42	67	39	9	8	4
12–15	M. F.	109 89	18	35	43	12	11	14	31
8–15		262	17	33	50	19	10	12	25

Chores. The younger children average 30 minutes per day for various chores around the house, and the older 44 minutes.

The relationship between health habits and functional disorders

The factor of sleep. It is commonly believed that lack of sleep will cause functional disorders. Just how much lack of sleep and over how long a period is required to produce such symptoms has never been studied. Neither do we know whether sleep alone or sleep in association with other inadequacies of living are necessary to produce such disorders. As a standard for adequate sleep the Seham schedule given in table 3, was used. Any sleeping schedule thirty minutes or more below that standard was considered inadequate. Moreover in scoring the function of sleep we considered the quality of sleep and the psychological background at the time the child went to bed, as well as the quantity of sleep. These items of course are impossible to measure.

The average number of hours for each age as revealed by the questionnaire is given in the last line marked with an asterick. It is apparently lower than the schedule used as a standard. Table 4 throws some light on the relationship between sleep on the one hand and functional disorders on the other. As can be seen there is an association between adequate sleep and good general health.

TABLE 3

Average number of hours of sleep by age groups as advised by various writers

	AGE									
	5 to 6	7	8	9	10	11	12	13	14	15
Terman	11.14	10.41	10.42	10.13	9.56	10.00	9.36	9.31	9.06	8.54
Ravenhill:										
Boys	10.30	10.30	9.30	9.15	9.15	8.45	8.15	8.30		
Girls	10.45	10.30	10.15	9.30	9.30	9.15	8.00	7.30		
Duke	13.50	13.00	12.50	12.00	11.50	11.00	10.50	10.00	10.00	9.50
Bernhard		11.00	11.00	11.00	10.50	10.50	10.00	10.00	9.50	
Hertel	11.00	10.50	10.50	10.00	10.00	9.75	9.50	9.50	9.00	9.00
Claparede	11.50	11.50	11.50	10.50	10.50	9.50	9.50	9.50	9.00	9.00
Manaceine	14.00	11.00	11.00	11.00	10.00	10.00	9.50	8.50	8.50	8.00
Krollich	11.00	11.00	11.00	11.00	10.50	10.50	10.00	10.00	9.50	9.00
Cavanagh		12.00								
Brown	11.50						10.00			
Pfaunder	11.00						9.00			
Key	11.00						10.00			
Seham		12.00	12.00	11.50	11.00	11.00	10.50	10.00	9.50	9.50
Seham			10.00	10.00	10.00		9.7	8.9	9.00	9.00

TABLE 4

The relationship between sleep on the one hand and functional disorders on the other

	HEALTH				FATIGUE				NERVOUSNESS			
	Good		Poor		Present		Absent		Present		Absent	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Adequate sleep	141	87	21	13	48	30	110	70	53	33	108	67
Inadequate sleep	27	28	71	72	52	52	48	48	46	47	51	53
D	59±04				22±04				14±04			
D/PE_d	144.75				5.50				3.50			

TABLE 5

The relationship between the number of hours of sleep on the one hand and fatigue and nervousness on the other in 190 children between the ages of 12 to 16 years

NUMBER OF HOURS OF SLEEP	FATIGUE				NERVOUSNESS				D	D/PE_d
	Present		Absent		Present		Absent			
	Number of cases	Per cent	Number of cases	Per cent	Number of cases	Per cent	Number of cases	Per cent		
7- 9	46	50	46	50	40	42	55	58	.08±.05	1.60
9-11	33	33	63	66	32	35	60	65	.02±.04	.50
11+	2	0	0	100	2	0	0	100		
D	17±.05				.07±.04					
D/PE_d	3.40				1.75					

Of the children with an adequate sleep schedule, eighty-seven per cent had good health and 13 per cent poor general health. The exact opposite is true in the group with inadequate sleep. This is a significant finding. The odds against the differences being a result of pure chance are more than 2 billions to 1.

In order to determine the significance of the differences of the probable errors of the means—the following formulas were used:

$$(1) \qquad PE_m = .6745 \frac{SD}{\sqrt{N}}$$

$$(2) \qquad PE_{D_{m_1-m_2}} = \sqrt{PE_{m_1}{}^2 + PE_{m_2}{}^2}$$

$$(3) \qquad \frac{D_{m_1-m_2}}{PE_D} = \text{Ratio}$$

A ratio of three means that the probability that the estimated difference arose purely as a result of chance is 4.3 per cent or to put it in other words—in 100 trials, a deviation of this size or greater would be expected to occur as a result of chance alone 4.3 times. If we express it in still a more practical way, we can say that the odds against the estimated ratio occurring as result of chance alone is 22.26 to 1. If the ratio is 4, the odds against such a deviation are 142.26 to 1. A difference is considered to be definitely significant if the odds are about 100 to 1 or greater. This scheme will be used throughout the rest of the paper.

There is a similar relationship though somewhat less pronounced between sleep and fatigue. Those with adequate sleep share symptoms of fatigue to the extent of 30 per cent as compared with fifty-two per cent in children who have inadequate sleep. This contrast is also shown in table 5, where we compare the quantity of sleep with the incidence of fatigue. Of the children who sleep between seven and nine hours, 50 per cent suffer from fatigue, of those having between nine and eleven hours only 33 per cent. Furthermore children having 11 hours or more had no symptoms of fatigue. It is true that the last group are too small to use for contrast but the tendency shows a high relationship between inadequate sleep and fatigue.

A similar relationship exists between "sleep" and "nervousness" as shown in tables 4 and 5. The term nervousness is used here to designate the symptom complex which usually goes under the name of "motor restlessness," or hyperkinesis. There is a definite difference in the incidence of these symptoms and signs in children who have an adequate amount of sleep and those who have an inadeqaute amount. The same relationship is evident when one compares the actual hours of sleep with "nervousness."

There also seems to be a significant association between sleep on the one hand and growing pains and headaches on the other (table 6). Children with adequate sleep gave histories of having growing pains to the extent of 15 per cent while those who had insufficient sleep complained of the same discomforts to the extent of 34 per cent. Again if a comparison is made with reference to headaches it is found that twice as many children complain of headaches in the latter group (68 per cent) than in the former (32 per cent).

Home study. It is to be expected that if home study is done in the evening it is bound to interfere with the amount of sleep. The answers to the questions as to home study reveals only the amount and not, at what time, it took place. However, there seems to be such a close relationship between adequacy of home study and adequacy of sleep that the deduction is justified that at least part of the home study was carried out in the evening (table 7).

Of children whose home study is adequate 67 per cent have adequate and 33 per cent inadequate sleep. On the other hand, of those children whose home study is excessive, only 25 per cent have adequate and 75 per cent have inadequate sleep. If we compare the younger with the older children practically the same figures are found as shown in table 8.

TABLE 6

The relationship between sleep on the one hand and growing pains, and headache on the other

	GROWING PAINS				HEADACHE				D	D/PE$_d$
	Present		Absent		Present		Absent			
	Number of cases	Per cent	Number of cases	Per cent	Number of cases	Per cent	Number of cases	Per cent		
Adequate sleep.....	25	15	138	85	53	32	109	67	18±.04	4.50
Inadequate sleep...	33	34	64	66	47	68	51	32	34±.04	8.50
D................	19±.04				35±.04					
D/PE$_d$...........	4.75				8.75					

TABLE 7

The relationship between home study and sleep

	SLEEP			
	Adequate		Inadequate	
	Number of cases	Per cent	Number of cases	Per cent
Adequate home study..	155	67	76	33
Excessive home study..	7	25	21	75
D.....................	42±06			
D/PE$_d$................	7.00			

Social activities. Here the relationship is not so definite. Among those whose social activities were considered adequate, 64 per cent were adequate in their sleep—and 36 per cent inadequate. Of those who were judged excessive in their social activity—45 per cent had adequate sleep against 55 per cent with inadequate sleep (table 9).

The factor of food. The question of diets has received during the last 10 years a great deal of attention in pediatric literature. Most of the literature is concerned with experimental studies on animals, primarily in the realm of chemistry. However, the question of the influence of food on function has remained a vast uncultivated field of research. We have shown in a previous article (1) that food and behavior in rats are related to one another as cause and effect and with that as a basis we were interested to see whether there exists a similar relationship between quantity of food and function in children. This is, of course, difficult to determine by a questionnaire study, which does not permit quantitative measurements of food intake. (See questionnaire num-

TABLE 8

Relationship between home study and sleep

	SLEEP								D	D/PE_d
	Younger				Older					
	Adequate		Inadequate		Adequate		Inadequate			
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent		
Adequate home study	33	60	22	40	122	70	54	30	10±.05	2.00
Excessive home study	0	0	6	100	7	31	15	69	31±.06	5.17
D	60±.05				39±.06					
D/PE_d	12.00				6.50					

TABLE 9

The relationship between social activity and sleep

Number of children, 259

	SLEEP			
	Adequate		Inadequate	
	Number of cases	Per cent	Number of cases	Per cent
Adequate social activity	147	64	79	36
Excessive social activity	15	45	18	55
D	19±06			
D/PE_d	3.17			

TABLE 10

The relationship between food on the one hand and functional disorders on the other

	GENERAL HEALTH		FATIGUE		NERVOUSNESS	
	Poor	Good	Present	Absent	Present	Absent
	per cent	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*
Adequate food	20	80	35	65	32	68
Inadequate food	19	81	42	58	43	57
D	1±.04		7±.04		11±.04	
D/PE_d	.25		1.75		2.75	

QUESTIONNAIRE OF "HEALTH HABITS." NO. I

(To be answered by the Child)

Name..............................Age........School..................................
Address.............................Grade........Date...............................

(1) What time do you get up in the morning? *No later than 7 o'clock.*
(2) What time do you eat breakfast? *No later than 7 o'clock.*
(3) How long does it take you to eat breakfast? *No less than 15 minutes.*
(4) What do you eat for breakfast? Mention the last breakfast you ate.
    (1) *Milk—fruit—and one other article.*
*(5) What time do you eat the noon meal?
(6) How long does it take you to eat the noon meal? *No less than 20 minutes.*
*(7) Do you eat the noon meal at home or at school?
(8) What do you eat for the noon meal? Mention the last noon meal you ate.
    (1) *Milk—at least 1 vegetable—one other article.*
(9) What time do you eat supper? *No later than 7 o'clock.*
(10) How long does it take you to eat supper? *No less than 30 minutes.*

(11) What do you eat for supper? Mention the last supper you ate.
    (1) *Meat—vegetables, desert, milk.*
(12) What vegetables do you eat? Mention each separately.
    (1)........(2)........(3)........(4)........ *At least 4 vegetables.*
    (5)........(6)........(7)........
(13) How many pieces of candy do you eat a day? *No more than 3.*
(14) At what time of day do you eat candy? *Not between meals.*
(15) How many cups of coffee do you drink daily? *Not more than 1 cup.*
(16) How many glasses of milk do you drink daily? *No less than 3.*
(17) How often do you use medicines for your bowels? *Not more than once a month.*
*(18) How often do you take a rest or nap in the daytime?
(19) How many hours a day do you play out of doors? *No less than 1, no more than 3.*
(20) How many hours do you play indoors? *No more than 1 hour.*
(21) How many hours do you spend in home study? *Depends upon age (see schedule).*
(22) When do you do your home study? *Preferably in the afternoon.*
(23) How many clubs do you belong to? *No more than one.*
(24) How many times a week do you meet with your club? *No more than once.*
(25) What time of day do you meet with your club? *Preferably afternoon.*
(26) How much time do you practice on your musical instrument? *No more than 1 hour a day.*
(27) At what time of day do you practice on your instrument? *Preferably afternoon.*
(28) What days of the week do you go to the movies? *Only weekends (once).*
(29) What time of day do you go to the movies? *Only afternoons.*
*(30) How often do you listen to the radio?
(31) What time of day do you listen to the radio? *Not later than scheduled bed-time.*
*(32) How far do you live from school?
*(33) Do you walk to and from school?
*(34) What work do you do at home for your mother?
(35) How long does it take you to do this work? *Not more than 1 hour daily.*
(36) What time of the day do you do this work? *Not before school or in the morning.*
*(37) What do you do after supper?
(38) What do you do before breakfast? *No work should be done.*
(39) What work do you do for pay? *No outside work.*
*(40) How long does this work take you?
(41) How much do you earn a week? *No work for pay outside home.*
(42) How many parties in the evening do you go to in a month? *No more than 2 a month.*
(43) What time of the week do you go to parties? *Only weekends.*
(44) How late do you stay at the party? *No later than scheduled time for sleep.*
(45) How many books do you read a week?
(46) Do you sleep with your window open? *Window should be opened.*
(47) Does anybody sleep in the same bed with you? *Should sleep alone.*
(48) How many sleep in the same room with you? *Should sleep alone in room.*
(49) What time do you go to bed? *See schedule.*
(50) How long does it take you to fall asleep? *No more than 30 minutes.*

ber 1, questions 2 to 17). There is practically the same relation between adequate food and general health as between sleep and general health—but for an unexplainable reason, there seems to be a larger amount of good general health than poor among the children with inadequate diet.

Fatigue occurs more frequently among the children with inadequate food. In the former there is 42 per cent showing fatigue; in the latter 35 per cent. The same is true of the incidence of nervousness. The causal relation between habits of living and functional disorders stands out even more strikingly if one relates food and sleep with functional disorders. Since the factor of safety is sufficiently large to enable the body as a whole to prevent or at least to postpone a physiologic breakdown though the strain on one organ or system may be constant one would hardly expect that one habit of living would produce abnormal changes in function. It is therefore surprising to find such a strong relation between inadequate sleep and food, either alone or in combination and functional disorders.

TABLE 11

The relationship between food and sleep on the one hand and functional disorders on the other

	GENERAL HEALTH				FATIGUE				NERVOUSNESS			
	Present		Absent		Present		Absent		Present		Absent	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Inadequate food and sleep	32	16	177	84	49	36	86	64	73	34	137	66
Adequate food and sleep	17	34	34	66	54	43	71	57	28	56	22	44
D	18±.05				7±.04				22±.05			
D/PE$_d$	3.60				1.75				4.40			

Physical status and health habits. To study the relationship between the physical status of the child and his health habits each child was examined carefully according to a standard form. On the basis of the findings the children were divided into 3 groups. In Group A were those physically superior, either normal or above in weight, a healthy appearance of skin and of color, no ascertainable physical defects, good posture, muscles were large and the muscle tone good. Group B were of average weight, with or without some slight defect which did not handicap the child functionally. Group C were 10 per cent or more below weight, malnourished, and definitely below par physically.

TABLE 12

Relationship between physical status and health habits

PHYSICAL STATUS	PERCENTAGE OF INCIDENCE						
	Adequate schedule	Inadequate sleep	Inadequate food	Excessive play	Excessive home study	Excessive social activity	Work for pay
A	11	29	26	13	8	8	5
B	8	29	28	20	5	5	4
C	11	22	31	14	8	6	8

Of course these are arbitrary classifications and therefore have their limitations of accuracy. There are however no better clinical methods of grouping children as to their physical status. In table 12 it can be seen that there is hardly any difference in the incidence of inadequate health habits in the three groups. Group C have somewhat less sleep than Group A.

The only suggestive difference is in regard to outside work for pay. About twice as many of the children in group C work for pay as in Groups A and B. To draw from these findings the inference that health habits do not effect the physical health status, is hardly justified. It would be safer to suggest that the effect of inadequate health habits is better studied on the individual child by comparing his habits of living with physical growth and development over a long period of time.

The incidence of functional disorders. The incidence of functional disorders was also computed by means of the questionnaire, number 2 (table 13). A larger number of children of the younger group are entirely free from functional disorders than the older only 16 per cent of all children are entirely free from pathologic physiology. Generally speaking the younger children are inferior to the older with respect to general health, and social efficiency. They are superior to the older children in school efficiency, they

TABLE 13

The percentage incidence of functional disorders in younger and older children

AGE	SEX	NUMBER OF CASES	NO FUNCTIONAL DISORDERS	POOR GENERAL HEALTH	SOCIAL MALADJUSTMENT	SCHOOL INEFFICIENCY	HEADACHES	GROWING PAINS	SEAT AND DESK MALADJUSTMENT	DEFECTIVE VISION	DEFECTIVE HEARING	FATIGUE	IDIOSYNCRASY TO FOOD	NERVOUSNESS	CIRCULATORY SYMPTOMS
years															
8–11	M. F.	34 30	22	22	38	23	45	31	12	28	0.4	31	30	39	0.9
12–15	M. F.	109 89	14	17	35	32	36	19	11	12	0.1	40	38	38	11
8–15		262	16	18	36	30	40	21	11	16	2	40	36	40	11

TABLE 14

The relationship between school efficiency on the one hand and fatigue and nervousness on the other

Number of children, 260

	FATIGUE				NERVOUSNESS				D	D/PE$_d$
	Present		Absent		Present		Absent			
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent		
Adequate school efficiency	54	31	117	69	56	31	121	69	0±.03	0
Inadequate school efficiency	56	63	32	37	44	53	39	47	10±.06	1.67
D	32±.04				22±.04					
D/PE$_d$	8.00				5.50					

show a higher percentage of headaches, and of growing pains. Their complaints of maladjustment to seats and desks are about the same. The incidence of defective vision and defective hearing is higher. They do not complain quite so much of fatigue symptoms nor of idiosyncracies to food. The amount of nervousness is about the same. There is a marked difference in favor of the younger group with respect to such circulatory disorders as dyspnoea, dizziness, fainting, and palpitation.

TABLE 15

The relationship between scholarship and school efficiency

	NUMBER OF CASES	SCHOOL EFFICIENCY			
		Good		Poor	
		Number of cases	Per cent	Number of cases	Per cent
B	49	42	89	7	11
C	108	85	80	23	20
D	57	26	45	31	55

The relationship between one functional disorder and another. Fatigue. There is a clinical point of difference between subjective fatigue which is expressed in the child's complaints of being tired, and objective fatigue which is an actual decrease in the child's ability and capacity for work. There is no recognized diagnostic method to determine the presence of objective fatigue, unless one uses scholarship as determined by the teacher as a criterion of mental efficiency. Good "scholarship" might indicate absence of mental fatigue, while poor "scholarship" might suggest mental fatigue. The school work was judged in 2 ways, first by the "school efficiency" represented by the answers of the child to questions 12 to 20 in questionnaire number 2 and the "scholarship" represented by the average marks for the two months preceding the questionnaire study. That there exists a close relationship between "school efficiency" (subjective) as judged by the child and "scholarship" (objective) as marked by the teacher is well brought out in table 15. For the purpose of computation "scholarship" was listed in 3 groups. Groups A and B (excellent) group C (average) and group D (poor). Of the children in A and B "school efficiency" was good in 89 per cent and poor in 11 per cent. In group C it was good in 80 per cent and poor in 20 per cent. In group D, however, there were 45 per cent with good and 55 per cent with poor efficiency. These findings would make permissible the use of "school efficiency" as an index of mental fatigue. If then school efficiency may be taken as a criterion of mental efficiency it may be said that among the group of children whose school work was adequate (A-B-C), only 31 per cent complained of symp-

TABLE 16

The relationship between scholarship and fatigue

	NUMBER OF CASES	FATIGUE			
		Present		Absent	
		Number of cases	Per cent	Number of cases	Per cent
A and B	47	16	34	31	66
C	108	38	35	70	65
D	59	30	51	29	49

toms of fatigue (table 16) whereas those whose school work was inadequate showed 51 per cent fatigue, quite a significant difference. Almost the same figures hold in regard to "nervousness," as shown in table 17. The significance of the differences between school efficiency on the one hand and fatigue and nervousness on the other is well shown in table 14. That the relationship between school efficiency and fatigue is high and positive, is more than a billion to one against its being a pure chance, and 19,000 to 1 in the case of school efficiency and nervousness. It can be said then that "scholarship" and "school efficiency" as these terms are used here are indices of a similar although not synonymous function and that subjective fatigue has a significant relationship to mental fatigue. Where fatigue is present circulatory symptoms are present in 23 per cent whereas among the children in whom fatigue is absent these symptoms are present in 4 per cent (table 18). In other words in a state of fatigue the incidence of circulatory symptoms is six times as high as when it is absent. This suggests the possibility that fatigue may predispose or make more likely the occurrence of circulatory signs and symptoms.

TABLE 17

The relationship between scholarship and nervousness

	NUMBER OF CASES	NERVOUSNESS			
		Present		Absent	
		Number of cases	Per cent	Number of cases	Per cent
A and B	49	15	30	34	70
C	110	42	38	68	62
D	58	28	48	30	52

Fatigue and headaches. We are prone to explain headaches upon a physical or an infective basis, and to accept the same causes in the child that are supposed to obtain in the adult. Apparently the literature on the subject does not consider headaches as due to inadequacy of health habits. There is no question that some children have headaches because of unusual excitement, emotional overstrain, lack of sleep and excessive play.

TABLE 18

The relationship between fatigue and circulatory symptoms

	CIRCULATORY SYMPTOMS			
	Absent		Present	
	Number of cases	Per cent	Number of cases	Per cent
Fatigue absent	151	96	6	4
Fatigue present	80	77	23	23
D	19±.03			
D/PE_d	6.33			

Among the children in whom fatigue was present, headache was associated to the extent of 49 per cent whereas in those in whom there was no complaint of fatigue, headache was present in only 32 per cent (table 19).

Fatigue and growing pains. Physicians usually look upon "growing pains" as rheumatic in nature. When fatigue is present growing pains are present in 38 per cent and where it is absent this disorder is present in only about one-fourth as many or 10 per cent of cases (table 20).

TABLE 19

The relationship between fatigue and headache

	HEADACHE			
	Absent		Present	
	Number of cases	Per cent	Number of cases	Per cent
Fatigue absent..........	109	68	49	32
Fatigue present.........	52	51	50	49
D....................	17±.04			
D/PE_d...............	4.25			

TABLE 20

The relationship between fatigue and growing pains

	GROWING PAINS			
	Present		Absent	
	Number of cases	Per cent	Number of cases	Per cent
Fatigue present.........	40	38	64	62
Fatigue absent..........	16	10	140	90
D....................	28±.04			
D/PE_d...............	7.00			

Fatigue and nervousness. Table 21 shows the relationship between the two most common disorders namely, subjective fatigue and "nervousness." (See questions 52 to 63 in questionnaire No. 2.) These two conditions appear together in 23 per cent, a higher association than in any two functional disorders. Alone they appear in about the same frequency. If fatigue is present "nervousness" also is present in 60 per cent of the cases. If fatigue is not present nervousness is present in 28 per cent. In other words among the children who complain of subjective fatigue, the incidence of "nervousness" is twice as high as among normal children. The fact that they are present in the same child at the same time to the extent of 60 per cent is certainly more than mere coincidence.

TABLE 21

The relationship between fatigue and nervousness in 260 children from eight to fifteen years

	NERVOUSNESS			
	Absent		Present	
	Number of cases	Per cent	Number of cases	Per cent
Fatigue absent..........	115	72	43	28
Fatigue present.........	41	40	61	60
D....................	32±.04			
D/PE_d...............	8.00			

Fatigue and work for pay. Do fatigue and work for pay frequently appear at the same time? The answer to this question (table 22) is decidedly

TABLE 22

The relationship between working for pay and fatigue

	FATIGUE			
	Absent		Present	
	Number of cases	Per cent	Number of cases	Per cent
Not working for pay....	128	77	68	33
Working for pay........	29	46	35	54
D....................	31±.04			
D/PE_d...............	7.75			

QUESTIONNAIRE OF "EFFICIENCY." NO. II

(*To be answered by the Child*)

Name..............................Age........School..................................
Address..............................Grade........Date..............................

(1) Do you always feel strong and well? *Yes.*
(2) Why don't you feel strong and well? *I always do.*
(3) Are your feelings ever hurt so badly that you cry? *No.*
(4) What hurts your feelings so that you cry? *Nothing.*
(5) Do you often get cross over little things? *No.*
*(6) What makes you cross?
(7) Do you giggle a great deal and find that you cannot help it? *No.*
(8) Do you think that you are easily excited? *No.*
*(9) What excites you easily?
(10) Do you make friends easily? *Yes.*
(11) Do you keep your friends long? *Yes.*
(12) Do you find school a hard place to get along in? *No.*
(13) Are you anxious to get away from school? *No.*
(14) Why are you anxious to get away from school? *I am not.*
(15) Do you like your teachers? *Yes.*
(16) Is it hard for you to pay attention to the work in school? *No.*
(17) Is it hard for you to learn? *No.*
(18) Is it hard for you to remember things? *No.*
(19) Do you finish what you start out to do? *Yes.*
(20) Why don't you finish what you start out to do? *I do.*
(21) How often do you have headaches? *Never (once a month).*
(22) Do you ever have headaches? *No.*
*(23) How many minutes or hours does your headache last?
*(24) At what time of the day does your headache come on?
(25) Do you get a headache after reading? *No.*
(26) Do you get a headache after play? *No.*
(27) Do you ever have backaches? *No.*
(28) How often do you have a backache? *Never (once a month).*
(29) When does your backache come on? *Never have them.*
(30) Do you ever have pains in your arms? *No.*
(31) How often do you have pain in your arms? *Never (once a month).*
*(32) When does the pain in your arms come on? *Never have them.*
(33) Do you ever have pain in your legs? *No.*
(34) How often do you have a pain in your legs? *Never.*
*(35) When does the pain in your legs come on? *Never have them.*
(36) Do any of your muscles ache when you are sitting at your school desk? *No.*
(37) How often do your muscles ache when you are sitting at your school desk? *Never.*
(38) Do your desk and seat hurt you? *No.*
*(39) When do your desk and seat hurt you? *Never.*
(40) Is your desk too high for you? *No.*
(41) Is your desk too low for you? *No.*
(42) Do your feet touch the floor when you are sitting at the desk? *Yes.*
(43) Do you feel cramped in your seat? *No.*
(44) Can you read the writing on the blackboard from where you sit? *Yes.*
(45) Do your eyes hurt you during reading in school? *No.*
(46) Do you have to hold your book close to your eyes when you read? *No.*
(47) Do you have to hold your book far from your eyes when you read? *No.*

(48) Do things ever get black before your eyes? *No.*
*(49) When do things get black before your eyes? *Never.*
(50) Can you hear the teacher from where you sit? *Yes.*
(51) Can you hear the other children recite from where you sit? *Yes.*
(52) Do you get sleepy in school? *No.*
(53) Do you get tired in school? *No.*
(54) When do you get tired in school? *Never.*
(55) Do you feel tired at noon? *No.*
(56) Do you feel tired after luncheon? *No.*
*(57) Why do you feel tired after luncheon? *I don't.*
*(58) Do you feel tired after school is out? *Either yes or nor.*
*(59) Do you feel tired in the evening before going to bed? *Yes or no.*
(60) Is it hard for you to get up in the morning? *No.*
(61) Why is it hard for you to get up in the morning? *It is not.*
(62) Do you feel sort of tired a great deal of the time? *No.*
(63) Do you usually sleep well? *Yes.*
(64) Are you hungry when you sit down at meal time? *Yes.*
(65) Do you enjoy your meals? *Yes.*
(66) What foods make you sick to your stomach? *None.*
(67) How often do you get sick to your stomach? *Never.*
(68) Can you sit still without moving around all the time? *Yes.*
(69) Do you play with the things on your desk a great deal? *No.*
(70) Do you bite your finger nails? *No.*
(71) Do you bite your lips? *No.*
(72) Do you suck your thumb? *No.*
(73) Do you pick your nose? *No.*
(74) Do you pick your face? *No.*
(75) Do you put your fingers through your hair a great deal? *No.*
(76) Do you get out of breath quickly? *No.*
(77) When do you get out of breath? *Only after running.*
(78) Does your heart pound so that you can hear it? *No.*
(79) When does your heart pound so that you can hear it? *After playing.*
(80) How often have you fainted away? *Never.* Have you ever fainted? *No.*
(81) How old were you when you fainted away? *I never have.*
*(82) Why did you faint away? *I didn't.*
(83) Do you get dizzy often? *No.*
(84) When do you get dizzy? *I don't.*

* Dummy questions.

"yes." This of course may not mean that work for pay in itself is a prime or sole cause of fatigue but one cannot ignore the factual information which this study reveals. Those who work for pay complain of fatigue to the extent of 54 per cent as compared to the others in whom fatigue was only present in 33 per cent, a difference of 21 per cent.

Fatigue and outside play. The amount of play which a child needs and what effect excessive play has upon the behaviour of a child over a long period of time are practical questions, precise answers to which cannot be given. Table 1 shows the average amount of out-of-door play the children of different ages indulge in. We use as a maximum schedule the figures suggested in this table. With this key as a guide, we found that there was 5 per cent more fatigue among the children whose play was considered excessive than among those whose play activity was considered adequate (table 23).

TABLE 23

The relationship between play activity and fatigue

	FATIGUE			
	Absent		Present	
	Number of cases	Per cent	Number of cases	Per cent
Adequate play activity...	130	61	83	39
Excessive play activity..	26	56	20	44
D....................	5±.05			
D/PE_d..............	1.00			

TABLE 24

A comparison of the relationship of play activity and fatigue between younger (61) and older (198) children

	FATIGUE								D	D/PE_d
	Younger				Older					
	Absent		Present		Absent		Present			
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent		
Adequate play activity.....	29	76	10	24	101	58	73	42	18±.06	3.00
Excessive play activity.....	12	54	10	46	14	58	10	42	4±10	.4
D........................	22±.09				0±.08					
D/PE_d...................	2.44				0					

Fatigue and posture. It is commonly believed that good posture and good general function of the body are closely associated. Orthopedists declare, that bad posture produces fatigue but they have not produced evidence that bad posture precedes the signs and symptoms of fatigue. Of the 36 children examined with special reference to posture such a small number had what may be considered good posture that one is hesitant to present the figures, and therefore any clinical evaluation. The contrast between the incidence of nervousness in children with good and bad posture is quite marked, about 24 per cent more nervousness occurring in the latter than the former. The same does not hold true with respect to fatigue (table 25).

As can be seen the children with poor posture seem to suffer less from fatigue, than those with good posture. No explanation can be offered for this seemingly illogical situation. A larger number of observations may clarify this point.

Headache and defective vision. Headaches are associated with poor vision in 25 per cent of the cases and 13 per cent suffer from poor vision but report no headaches (table 26).

The relationship between functional disorders and physical status. It was of interest to see whether functional disorders went hand in hand with the physical status of a child. If this were so we should expect to find a higher incidence of functional disorders among those graded B a C, than among those graded A. There is a larger number of normal children in Group A than in Group C. Their general health is better. The children physically superior show a superiority in regard to school efficiency. The incidence of growing pains and defective hearing is smaller. As regards fatigue and nervousness, however, the incidence is higher in Groups A and B, than in C.

TABLE 25

The relationship between posture on the one hand and nervousness and fatigue on the other

	NERVOUSNESS (1) AND (2)				FATIGUE			
	Present		Absent		Present		Absent	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Good posture	6	38	10	62	4	50	4	50
Poor posture	28	62	17	38	9	32	19	68
D	24±.09				18±.09			
D/PE$_d$	2.67				2.00			

TABLE 26

The relationship between headache and vision

	VISION			
	Good		Poor	
	Number of cases	Per cent	Number of cases	Per cent
Headaches absent	141	87	20	13
Headaches present	75	75	24	25
D	12±.04			
D/PE$_d$	3.00			

TABLE 27

Relationship between physical status and functional disorders

PHYSICAL STATUS	PERCENTAGE OF INCIDENCE												
	No functional disorders	Poor general health	Social maladjustment	School inefficiency	Headaches	Growing pains	Seat and desk maladjustment	Defective vision	Defective hearing	Fatigue	Idiosyncrasy to food	Nervousness	Circulatory symptoms
A	10	33	12	3	12	5	5	7	0	13	8	17	5
B	3	6	11	9	13	8	6	7	0	11	10	10	5
C	8	10	11	8	12	7	3	5	3	8	8	14	3

SUMMARY AND CONCLUSIONS

A. By the use of the questionnaires the reliability and validity of which may be questioned, we have tried in this paper to determine

(1) The percentage incidence of health habits in 262 school

children of from eight to fifteen years of age.
- (2) The relation between health habits and functional disorders.
- (3) The relation between one health habit and another.
- (4) The percentage incidence of functional disorders.
- (5) The relation between one functional disorder and another.

B. A quantitative study was made of the following health habits of school children of a mixed social and racial group, chiefly poor and of foreign stock. Namely:

- (1) Sleep.
- (2) Food.
- (3) Home study.
- (4) Social activities.
- (5) Outside play.
- (6) Work for pay.

C. A qualitative and quantitative statistical study was made of the following functional disorders:

- (1) General health.
- (2) Social maladjustment.
- (3) School efficiency.
- (4) Headaches.
- (5) Growing pains.
- (6) Seat and desk maladjustment.
- (7) Defective vision.
- (8) Defective hearing.
- (9) Fatigue.
- (10) Ideosyncracies to food.
- (11) Nervousness.
- (12) Circulatory symptoms and signs.

D. The physically inferior children do not have a larger number of inadequate health habits than the superior children, nor do they show a significantly higher incidence of functional disorders.

E. There is a strong concomitance statistically between inadequate Health Habits and Functional Disorders.

F. Statistically there exists a strong relationship between School Efficiency (subjective) and scholarship (objective). If "School Efficiency" is used as an index of mental fatigue, then "Scholarship" and "School Efficiency" are indices of a similar, though not synonymous, function.

G. With the exception of (1) Inadequate Food and General Health and (2) Poor Posture and Fatigue—all the other associations studied between Health Habits and Functional Disorders are positive. No explanation can be offered for these two exceptions at this time.

H. Using Pearl's Table—we can group all of the relationships as follows:

I. Highly significant:

- (1) Inadequate sleep and poor general health (more than 2 billion to 1).
- (2) Inadequate sleep and fatigue (19,000 to 1).
- (3) Inadequate sleep and headaches (2 billion to 1).
- (4) Inadequate sleep and home study (400,000 to 1).
- (5) Inadequate food and sleep and nervousness (332 to 1).
- (6) School efficiency and fatigue (more than 1 billion to 1).
- (7) School efficiency and nervousness (19,000 to 1).
- (8) Fatigue and circulatory symptoms (19,000 to 1).
- (9) Fatigue and growing pains (400,000 to 1).

- (10) Fatigue and headaches (over 200 to 1).
- (11) Fatigue and nervousness (over 1 billion to 1).
- (12) Fatigue and work for pay (over 1 billion to 1).

II. Definitely significant:

- (1) Inadequate sleep and growing pains (825 to 1)
- (2) Inhibition and nervousness (4.63 = 520 to 1).
- (3) Inadequate food and sleep and poor general health (65 to 1).

III. Positive tendencies (probably not significant):

- (1) Inadequate sleep and nervousness (54 to 1).
- (2) Inadequate sleep and social activities (32 to 1).
- (3) Inadequate food and fatigue (4 to 1).
- (4) Inadequate food and nervousness (15 to 1).
- (5) Inadequate food and sleep and fatigue (4 to 1).
- (6) Poor posture and nervousness (20 to 1).
- (7) Headache and poor vision (22 to 1).

IV. Not significant:

- (1) Inadequate diet and poor general health.
- (2) Fatigue and outside play.
- (3) Poor posture and fatigue.

I. We do not feel justified at this time, even in the most significant associations and relationships to consider association as synonymous with causation.

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The Treatment of Defective Speech Due to Cleft Palate and Associated Conditions[1]

DON C. LYONS

SPEECH, is sound produced by the passage of expired or exhaled air through an elastic tube composed of the tissue which makes up the pharynx, the oral, and the nasal cavities. If all tissue relationships in and about this tube are normal, fully developed, and completely coördinated with the muscular and with nerve activity, the passage of air in this tube produces full rounded voice sounds which we call correct speech. On the other hand, anything which alters the amount of air which passes, or which changes the shape of the air column, produces what we term, defective speech.

Usually there are six possible factors which may produce defective voice sounds or speech. These according to various authors are as follows:

1. Inability to appreciate the meaning of word sounds.
2. Disturbances in hearing.
3. Defective mental development.
4. Conditions which prevent the normal control of the muscles of articulation.
5. The child's inability to coördinate nerve centers which have been maladjusted, not a mental deficiency.
6. Mechanical defects in the voice passage.

While the author is interested primarily in the last of the causes of defective speech just mentioned, he feels that the final result of the treatment of any mechanical defect lies in the correct appreciation of all other associated factors. Therefore the treatment of defective speech as caused by failure of the palate to close must embrace more than just the operative procedure.

One can group the types of congenital failure according to the amount of tissue involved. Brophy classified this anomaly of development into fifteen groups starting with the simple bifid uvala, then the cleft of the uvala extending forward to the fibers of the levator palati, then the entire soft palate, the cleft involving the hard palate to the alveolar ridge, then the one which involves one side of the premaxillary process, both sides. Further a group involving just the premaxillary process extending through a series of failure of development to total aplasia.

In the past the oral surgeon or general surgeon who operated for the relief of the cleft of the palate, felt that the operation had been a success if the cleft was closed. The operation might take several repetitions, but closure was the eventual goal. Unfortunately, too often the result was closure at the expense of the velum and a much scarred, greatly shortened, rigid tissue was left which was practically useless from a speech standpoint. Even though the operation was termed an operative success, it was far from a functional one. Today, the first aim of the surgeon is function, for without a tissue capable of responding to all the demands of phonetics, there is little value in closing the cleft.

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[1] Read before the Michigan League for the Rehabilitation of Speech in Joint Session with the Michigan School Masters Club at the University of Michigan, Ann Arbor, Michigan, April 28, 1934.

The soft palate is composed of five pairs of muscles, the pharyngo palatini, the muscularis uvali, the levator veli palatini, the tensor palatini, and the glosso palatini. These muscles acting against each other raise and depress the velum, relax and tighten it. The muscularis uvali in the child usually becomes a single muscle, but at birth and in the cleft palate is a double muscle. Fortunately if this is bifid there is little disturbance to many voice sounds and there are probably many individuals who have this first degree cleft palate who are completely unaware of it.

There are at present two different groups of operators, each feeling that his method of closure of the cleft is best. The first group is that which follow the principles laid down by Brophy some years ago. He felt that the reduction of the width of the cleft straight in from the tuberosities of the maxilla was of great importance, and to do this used the direct application of force and lead plates with silver wires to hold the segments in place until union took place. The second group feel that only an indirect force is necessary. The cleft is adapted at the alveolar ridge, the lip repaired, and then the action of the muscles restored to function by this repair is depended upon to complete the reduction. In the first method the early use of wires and plates called for relaxation of the muscles by cutting. Even then the tention often caused the wires to cut through and produced considerable scar tissue. Naturally such a method did close the hard palate but frequently produced a useless velum. The second method produces a good velum, but does not take into consideration the reduction of the width of the cleft at the posterior border of the hard palate. While it is felt by this group that this width gradually reduces as the child grows, the chances of operative failure are much greater because of the greater distance that tissue must be bridged.

A third group offer still another solution, that being the use of the Thiersch graft or of a Pedicle graft of tissue. Such operative procedures are of great value when previous operative procedures have caused sloughing or destruction of tissue, or in adult cases which would be otherwise inoperable, but one must remember that there is no muscular tissue in such grafts, and from a phonetic standpoint, they are absolutely useless. Further the numerous stage operations needed cause considerable scar tissue. It is possible in some cases to make a sort of a velum in this procedure by transforming the tensor palatini into a levator by breaking off the hamular process of the external pterygoid plate as Dorrance and others have suggested.

If the operation for the relief of the cleft palate is to be a success from the standpoint of restoring function to the velum and normal surfaces for the articulation of sounds, it is very important that the child be operated on as early as possible, or advisable. The word, 'advisable' is used because most of such babies are malnourished due to inability to eat properly, and often suffer from respiratory infections, because of the oral-nasal condition. Such things must be corrected as far as possible before operation. Early operation is advised because the bony structure can be molded and the maxillary bone approximated more easily. There is less deformity at this time which also permits the tissue to return to normal relationships quicker. An early operation permits the muscles of the soft palate to be brought into operation before they have atrophied from disuse. The earlier the operation the better is the chance for normal speech development. It is especially necessary to relieve the conditions before speech habits develop. From a purely surgical viewpoint the early operation is advised because there is less possibility for surgical shock and early operation avoids the possibility of malnourishment during childhood and the danger of pneumonia which these babies face.

The treatment of the defective speech after operation is necessary. Simple closure of the cleft, even perfect restoration of the velum is not sufficient; speech training is usually necessary. If the child is operated upon quickly after birth, very little training other than that which the usual mother gives her child is necessary. However, it is unfortunate, but many of these children never are operated upon until after the speech habits are formed. This is especially true if there is not an associated cleft lip.

The unrelieved cleft palate places a mental handicap on the child. Such a child quickly gets out of contact with the rest of the world. He is seldom seen playing with other children of his age. He is unable to meet the usual social contacts of daily life without feeling a deep sense of inferiority or of abnormality. He draws himself into his shell and stays there, developing the mental attitude and mental activity of congenital deficiency. This is the problem which confronts the teacher. Even after the cleft palate has been corrected, it takes many months or years to break this mental attitude. Fortunately in most instances one finds the IQ near the normal range and word perception is normal. The actual problem consists in teaching the child to project the stream of air through the mouth rather than the nose, and to change tongue and muscle habits. Woldstad (5) gives a splendid suggestion as to how to overcome the associated mental handicap. She suggests that the child be taught to excel in some field of endeavor so that he will not have a sense of inferiority, his superiority counterbalancing the handicap.

There is still much which must be done by the oral surgeon in devising an operation which will successfully restore all the phonetic power of the palate as well as close the cleft.

Treatment of the defect depends more than any one thing upon early recognition, early operative intervention, and early speech training.

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Variation in Susceptibility to the Conditioning of Inhibition as an Index of Constitutional Type

EDWINA A. COWAN AND MARJORIE FOULKE

THE work herein reported was conducted at the Wichita Child Research Laboratory between September, 1930, and March, 1934. It was an attempt to add one more to the battery of tests, still unfortunately limited, at the service of the examiner who undertakes to obtain accurate, quantitative information concerning the mental make-up of children needing clinical examination. To earn a place in the battery used by a conscientious examiner under such circumstances, a test must meet certain specifications; it must be reliably standardized; it must yield information the nature of which is helpful in a reasonable number of cases in determining what shall be done about the case after the evidence is all in; the giving of the test must involve apparatus, testing technique and an amount of time all within the reach of the average examiner called upon to furnish information needed by those responsible for the training of children. It is in the belief that the test arrived at through the work herein reported meets these specifications that we offer it for consideration.

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PROBLEM

Whatever may be one's theoretical bias toward the general problem of constitutional type and, more particularly, toward types as differentiated by Pavlov (46) into over-excitatory, over-inhibitory and plastic, and whatever may be one's degree of willingness to accept his physiological explanation for these constitutional types, the fact remains that one cannot have a share in the training of large numbers of children without recognizing that it is almost impossible to teach some of them not to do things, that it is equally impossible to make others do anything at certain times, and that there is a third group who are always open to reasonable persuasion but are capable of controlling their own impulses if appropriately motivated. When one is dealing with a child it is of great advantage to be able to know in advance his proper placement among these groups. The training methods adapted to one group will fail completely with children of another. So clear-cut is the difference in their requirements that in making placement for adoption, an entirely different type of foster parent is sought for children of the two extreme groups. If this difference is a genuine constitutional difference (and in the light of our results we believe it to be) then it should not be necessary to depend upon fairly long time observation by a skilled observer for knowledge as to the group in which a given child should be included. In the case of such an important constitutional difference a usable and reasonably reliable test which will make possible a quantitative judgment of this difference becomes valuable to the examiner. Our present problem was: first, the devising of a test which should differentiate between children on the basis of ease with which inhibition could be conditioned; and second, to determine if possible by means of this test whether the assumption is sound that this difference in ease is constitutional.

Historical background of the problem

The problem of constitutional type is a lineal descendent of the ancient problem of temperament. Whatever the classifications arrived at, we find in the earliest classical discussions of temperament three primary concepts from which any valid discussion of the subject must take its departure: temperament must differ in individuals in such a way as to permit classification; it must be inborn; and it must be some quality common to the whole personality. That the modern discussions of constitutional type have not been deflected from these three basic concepts by changing the name of the problem is shown by a recent definition of the word "constitution": "Constitution is the total of bodily and psychical (both normal and morbid) qualities transmitted by heredity, i.e., in purely endogenous ways" (36).

Opposed, however, to the summary dismissal, found in the classical discussions, of the problem of temperament with a more or less arbitrary classification and a generalized description of type, we find the modern workers in this field developing new classifications of type, attempting to correlate type differences with differences in physiological mechanisms, and developing type descriptions on the basis of individual differentiations arrived at under experimental conditions.

Best known of the older classifications of temperament is the grouping which divides people into cholerics, melancholics, sanguines and phlegmatics. This grouping has been followed in a general way by Pavlov, but elaborated into over-excitatory, over-inhibitory, lively and stolid plastic types, which Pavlov (46) correlates with physiological conditions within the central nervous system. A new departure in classification was made by Jung (24, 25, 26) when he divided people into extroverts and introverts. This innovation was followed by other new classifications which used several different kinds of variations among individuals as the basis for their groupings.

One basis for constitutional differentiation is that which divides people into pre-psychotic and non-prepsychotic groups, and again divides the pre-psychotic types into those which are predisposed to one or another kind of abnormality. This basis for classification of types is exemplified by the following systems. According to Hunt (22, 23) people may be divided into erethitic and kolytic types. Orbison (43) mentions constitutional psychopathic inferior personalities and classifies them with regard to the following traits (with behavior as his chief criterion): (1) hereditary taint; (2) hyper- or hypo-irritability of emotional sphere; (3) imbalance of judgment control over behavior and other voluntary acts; (4) imbalance of reason; (5) lack of true appreciation of moral or ethical values. Among constitutional psychopathic inferiors he includes the following subdivisions: (1) inferior or inadequate personality; (2) paranoid; (3) emotional instability; (4) criminalism (admits too vague); (5) pathologic lying and stealing; (6) sexual psychopathy; (7) nomadism (too vague).

The schizoid vs. cycloid classification of Kretschmer has been accepted as the basis for variations of his classification, the variations largely consisting of the identification of types lying between the extremes and of subdivisions of each of the extremes.

We also have the definition by Ravà (54) of temperaments into two types, instinctive and emotive. Disturbances of the instinctive type result in exaggerated activity, as in manic-depressives, while disturbances of the latter mean exalted emotivity, as in neurasthenics and psychasthenics.

On the basis of his own experimental technique in uniting motor activity with verbal reactions, Luria (31) classifies people into two types: the reactively stable and the reactively labile. The reactively stable are those in whom difficult situations do not cause break-down of the "functional barrier" between uncoördinated and coördinated activities, and therefore cause no delay of the coördinated activity. The reactively labile are those in whom the difficult situation causes the "functional barrier" to break down, and coördinated motor activity is superseded by uncoördinated motor activity.

Perhaps we should include in this connection the studies of pre-psychotic personality by Bigelow, Blalock, Courbon, Steinitz, Guiraud, Enke, and del Greco (4), (5), (8), (58), (19), (13) and (9) in an effort to arrive at a descriptive analysis which would make the pre-psychotic recognizable before objective criteria of mental disease are available. Insofar as this descriptive analysis includes constitutional traits, the pre-psychotic individual forms a group among constitutional types.

In addition to the foregoing which stress the psychotic and pre-psychotic types, we have the classification of types dealing more particularly with differentiations among average people. Individual differences in the mechanisms of learning have appeared to some authors as constitutional differences, and we have the following distinctions drawn: children were classified by Osipova (45 and 44) into associative-stimulative and associative-inhibitive types, according to the speed with which they formed association reflexes; the first type forms associative reflexes quickly, the second slowly.

Henning (20) in asking his subjects to draw or write something which they would consider entirely different from the figures, drawing, words or sentences shown to them, believed that he could distinguish two types: the first type is always influenced by examples of some sort (samples, current opinion, phrases, dogma, etc.); the second type arrives at solutions which in no way remind one of the examples.

The presence or absence of eidetic imagery (30, 23 and 65) constitutes another basis for type determination, and those possessing eidetic imagery are further differentiated. The B (Basedow)-type refers to an eidetic imagery which is produced, dismissed and changed at will; similar in color to the stimulus object; detailed; and fluctuating in general character. The T (Tetany)-type is more independent of control; often of complementary color to the stimulus object; in general character fixed and unfluctuating. One or other of these types of eidetic imagery may occur predominantly in the experience of any one individual or the same person may experience both types. Jaensch's attempts to correlate these differences with physiological and personality differences have led him to postulate the predominance of B-type or T-type as the manifestation of a constitutional factor.

Washburn, Keeler, New and Parshall (62) regard the following opposite extremes as temperamental traits: emotional-calm; irritable-non-irritable; timid-fearless; and extrovert-introvert.

Furukawa (14) differentiates between individuals of active temperament and those of passive temperament.

Pende (49) describes two fundamental temperament types: individuals who possess an exaggerated functional tonus of the sympathetic system and the auxiliary glands, as opposed to those displaying a hyperfunctioning of the parasympathetic system.

In addition to the foregoing classifications of constitutional types, we have those based more directly on structural and physiological individual differences, constitutional in their nature. Perhaps the best known is Kretschmer's (28) classification of pyknic, athletic, and asthenic.

Galant (15) presents a system of constitutional types for women which classifies them into: (1) the stenosomic constitutional group, including the asthenic type, or the very small woman, and the stenoplastic type, or the robust asthenic; (2) the mesosomic constitutional group, which includes the pyknic type, or the ideal of womankind, and the mesoplastic type, or the work-type of woman; (3) the megalosomic group, made up of the athletic type, or the masculine type of woman, and the subathletic type, or the slenderly built, athletic type, and the euryplastic type, or the very large woman.

MacAuliffe (32) distinguishes a round type of slackened vitality and a flat type of accelerated vitality. Similarly, Pende, (48 and 47) classifies into the following types: anabolic type (short round, vagotonic, with predominance of thymus, adrenal and genital glands; emotionally stable); catabolic type (long, flat, sympathotonic, with predominance of thyroid, parathyroids and hypophysis; emotionally unstable); eurythmic type (harmoniously balanced).

Bouyer (6) offers a group of pyknoids which lies between the pyknic and athletic types in its characteristics.

The attempts to correlate differences in constitutional type with characteristic differences in physiological and psycho-physical mechanisms have been varied in their mode of attack. The relationship of temperament to the results of different types of intelligence tests and ratings has been studied by Oates (39, 40, 41), Porteus and Babcock (53), and Peters (51). Ödegaard (42) observes differences in psychogalvanic reactivity among psychiatric patients whom he groups into six diagnostic groups as follows: normals, organic and toxic psychoses, hysteria, depressions and neuroses, manic excitement, schizophrenia. Washburn, Keeler, New, and Parshall (62) found differences between some of their opposite extremes of temperamental traits which corresponded to differences in speed of reaction to noise, variability of such reaction time, and number of errors made in mirror-tracing of an outline star. Tedesco (1) found that the values of the cardio-vascular pressure were higher in individuals of the asthenic type than in the pyknic type between the ages of twelve to sixteen years. For individuals between seventeen and nineteen years this condition is reversed, and the values of the cardio-vascular pressure are higher for those of the pyknic type.

Differences in the reinstatement of experience through memory were found by Washburn and her associates (60, 61, 63, 59, 64) to be characteristic of temperamental differences between the emotional and the calm groups. Both directed and free recollection of emotional experience were richer among the emotional group. The emotional subjects have slightly more intense and numerous recollections of emotion, especially the disagreeable emotions, and greater galvanometric deflections. Those of cheerful temperament find more pleasant associations to words than those of depressed temperament.

Baxter (2) investigated the rate and strength factors as related to temperament, with negative results.

Moore (37) found greater speed of reaction, ease of breaking up habits, readiness to make snap judgments and independence in the face of majority influence more evident in individuals of radical temperaments than among conservatives.

Kretschmer (27) correlated sensory and perceptual differences with constitutional types.

Bensheim (3) correlated differences in the effects of mescal intoxication with the psychothymic and schizothymic groups.

Individual differences in motor coördination, as exemplified in handwriting, mirror-drawing, and speech, were used by June Downey (10) as indications of individual differences with regard to temperamental traits.

The relation of range and degree of fluctuation of attention to constitutional type was experimentally tested by Reiter and Sterzinger (55). The results indicated some relationship between the range of attention and the types of Kretschmer, but this relationship was not marked.

Collins (7) working with repeat tests of the Pressey Form B test, did not find consistency of results when he gave the tests to the same individuals after intervals of a week and a year, and concluded that the Pressey Form B test did not test a constitutional factor.

Emotional and intellectual reactions to ink blots have been used by Rorschach and others as guides to temperamental differences.

As illustrations of the application of the constitutional type concept to physiological mechanisms we have the attempt to correlate personality and intellectual characteristics with general body build, pyknic, athletic and asthenic types of Kretschmer (27), and Schmidt (56), and Graf (18), with rate of growth, (50), with height-weight relationships (16), with somatograms and cephalograms (52), with sugar content of the blood (29), with the chemical balance within the body (34), and with the results of isoagglutinin blood tests (14).

In some instances individuals have been accepted as belonging in one or another classification of constitutional type and experimental attempts have been made to arrive at a cataloguing of characteristics belonging to this type which could be used for the purpose of diagnostic identification of the type in the case of other individuals.

Enke (12) studied the motor processes of 250 people whom he had classified according to the Kretschmer catagories. The members of the pyknic group were characterized by motor expressions of continuous internal feelings of tension. They were less skillful in fine hand movements than leptosomes, and were not so well able to isolate individual fine movements within the attention field. In another study Enke (14) investigated the relation between motor peculiarities and bodily morphology, using 500 male and female subjects, whose ages varied from sixteen to sixty-five, and who showed a wide degree of variation in intelligence and training. The subjects were again grouped according to the Kretschmer classification. Tapping, breathing technique, tests for steadiness, speed and accuracy of motor coördination were used. The author finds a slower tempo and greater pattern irregularity of movement in pyknics. Pyknics, however, adapt themselves better to changed movement sequences. He feels that psychomotor factors are valuable indices of constitutional type.

Gourewitch and Ozeretzki (17) examined 8,167 people and chose 4,858 cases whom they felt were clearly recognizable examples of the following constitutional types: the leptosomic, athletic, pyknic, infantile, and dysplastic. The others they discarded as being of mixed type. Correlations were sought between character and motor ability, between somatic constitution and motor ability, and between bodily constitution and character. The authors found that the psychomotor ability was distributed among four types as follows: the psychothymic pyknic, the schizothymic leptosomic, the athletic epithymic, and the infantile labile.

Neeb (38) placed individuals in temperamental groups on the basis of

Kretschmer's classification, and sought to arrive at a descriptive concept of the types through intelligence tests, school grades, and ratings of vocational aptitudes. No clear-cut descriptive concept of these types was arrived at.

Sorokhtin (57) chose a group of children of school age whom he characterized as brake-type on the basis of their behavior under experimental conditions for conditioning the pressure of the hand on a key to a red light combined with electric currents. When the children had been diagnosed in this manner as to type their general personality and behavior characteristics as revealed by observation in school and medical examination were catalogued as descriptive of this brake-type. According to the authors the following interpretation is characteristic of this type: in the motor sphere, swiftness of action, normal or lower than normal; regularity and strength are high; the tempo of action is low and even; dynamic durability is normal and static durability higher than normal. The characteristics of these children in pedagogical situations are consistent within the group (may be termed socially stable) and may be described as follows: (1) They have good discipline. They actively support order and distinguish themselves as being reliable in responsible work; any flaw in their adherence to discipline could be traced to an outburst of negativism; some subjects of the group were very stubborn, but this did not interfere with the success of the social contact with their companions. (2) They display ability for long-time concentration in their work (3) They are very persistent and always finish their task. (4) They are independent in their work. (5) In new work they are slow to orientate and inclined to be slovenly. (6) They do work with moderate or slow speed, with even tempo, and with accurate execution. (7) Emotionally they are reserved and they are moderate in character. (8) Non-sociability or introversion is an outstanding trait of the whole group.

Yarmolenko (66) on the basis of tests of motor coördination which included throwing of balls, striking of sand-bags and walking along a straight line and along circles, following directions as to speed and change of motion, and jumping, worked out a motor profile correlated with age of the children. These children were then grouped into those of brake-type, plastic type, and excitable type, on the basis of the reflexological diagnosis used by Dr. Sorokhtin and the motor profile studied from the point of view of type differentiation. He arrives at the conclusion that the excitable type gives a wide variation of the age coefficient in the direction of plus and minus. The force of the impact and the over-jump is large, but continuous muscular exertion is difficult. Their endurance is not very good. The brake type moves more slowly but more accurately and with greater sureness. Force and endurance are high in this type. The plastic type does not give a typical relationship between coefficients. The author feels that a priori an individual's motor profile should bear the traces of brake or excitable type, according to the type toward which he is more inclined.

One cannot consider the work which

has been done on constitutional type without being struck by the following facts: many of the classifications are of kinds of behavior rather than sorts of people. This gives rise immediately to the difficulty of mixed types. Certainly a grouping of people which leaves 50 per cent outside any of the groups can offer no substantial assistance to the diagnostitian, nor any hope of arriving at a clear-cut symptomatic description valuable for prognosis. A classification which breaks down frequently into mixed types appears to be a classification of aspects of the behavior of people rather than a classification of people. A large number of borderline types is conceivable in a satisfactory classification of constitutional types, but a large number of mixed types is in itself strongly suggestive of the unsoundness of the classification concept which necessitates this inclusion in its system.

There are classifications to which this objection does not apply, and these more nearly approach a true segregation of people into group types. But even these classifications seem too broad in their original delineation. Differentiation is drawn between groups of traits and type names given to these characteristic groups, without first determining definitely that the constellations of traits characterized as constitutional types include only constitutional traits. It is as if we were to say that a combination of blue eyes, short hair, dark skin, well manicured finger nails, small bones and an upright carriage constitute a type we might call Celtic. These are all physical characteristics in regard to which adults differ, and conceivably we might find many individuals who would fit this exact description in regard to all of these particulars. But inasmuch as variation in regard to grooming of finger nails, posture, and length of hair (none of them constitutional traits) would prevent inclusion of individuals in the group, we could not properly designate the group as an authentic constitutional type. The Celtic type, for instance, is a genuinely recognizable racial type, but it is described in terms of color of hair, color of eyes, and complexion. These are all constitutional physical characteristics. In order to have a Celtic type, one must have these in a given quality and a complete group. Any one of these characteristics may be found outside the Celtic group, but when we have lost one of them from the group we have lost the Celtic type. But no matter how variously scattered these constitutional characteristics may become through hereditary mixture and diffusion, whenever, through the mechanics of heredity, they are again all reassembled in one individual, the Celtic type is restored to us.

It would then appear necessary, before arriving at a classification of temperamental or constitutional types, to determine first what individual constitutional traits are involved in temperament, and then it may be possible to arrive at groupings of these traits which will be found to be shared as characteristic groupings by large numbers of people. The confusion of constitutional and non-constitutional characteristics is especially evident in those studies which attempt to arrive at symptomatic psychological descriptions of hypothetical types. In this connection all sorts of behavior have been catalogued with no regard for the question as to whether this behavior represented constitutional psychological traits. There may, indeed, be some question as to whether it is possible to determine the constitutional character of any psychological trait which may be properly described as a quality common to the whole personality. But surely until this fundamental question is answered we have no right to include traits in symptomatic descriptions of constitutional type merely because they are of psychological quality. Such functions as steadiness, speed and accuracy of motor coördination may in the end be proved to be constitutional, but in view of the fact that even casual observation shows that these functions vary widely in one individual from day to day and from year to year, their constitutional character must be proved and not assumed.

The first problem facing those now working in the field of temperament and constitutional type seems to be to discover functions of the nervous system which are authentic constitutional traits, and to devise ways of measuring individual differences in these traits. Later, characteristic groupings of these traits may be found which will form true temperamental categories in which people can be placed with surety that those in any one category resemble each other in a manner genuinely constitutional. The studies of eidetic imagery come nearest to meeting this requirement up to date; but indications of profound differences between the childhood and adult experiences of individuals possessing eidetic imagery leave us in some doubt as to the constitutional character of this phenomenon. It seems entirely possible that all people may experience eidetic imagery at some time during their lives and quantitative differences in its persistence into adult life may not be constitutional in their nature.

McDougall (34) in pointing out that previous classifications have not analyzed the constituent factors of types, offers the following analysis of groups of such factors: (1) intellect (memory imagery); (2) disposition (affective); (3) temper (drive); (4) temperament (endocrine); (5) character (acquired organization of affective tendencies). While he feels that Jung ascribes too much significance to the introvert and extrovert differentiation, and that this emphasis leads to confusion, McDougall himself presents the extrovert-introvert scale for singling out as a constitutional personality factor, and discusses this difference as one which involves inhibition. In the case of the introvert he believes the lower levels of the central nervous system are subject to a high degree of inhibition by cortical activity. According to his drainage theory of inhibition the excitation of the thalamic centers (constituting emotion) is directed to the cortex and sustains activity there. With increasing maturity of the organism greater cortical control develops, and the individual becomes correspondingly more highly introvert.

The terms introversion and extroversion express the limits of individual variation of the degree of freedom with which this affective overflow takes place; and this variation McDougall assumes to be constitutional. He postulates an unknown substance in the nervous system similar in its effect to alcohol or chloroform, which sets up excitation. The extrovert would be an individual who had unusually little resistance to this substance, and is perpetually in a state of mild intoxication.

Other authors have been interested in inhibition as a constitutional factor offering individual variations. Pavlov (46) demonstrated that inhibitions could be conditioned, and believes he has evidence that individuals display a basic difference in the readiness and ease with which this conditioning of inhibition takes place within the organism. He describes the over-excitatory individual as one in whom inhibitions are conditioned seldom and with great difficulty. The over-inhibitory type is the type in whom inhibitions are conditioned too easily for perfect adaptation to a changing environment. Between these extremes lies the plastic group, in whom inhibitions are set up with sufficient ease to assure protection, but not to the extent which prevents adaptation. This variation, which he regards as constitutional, he correlates with hypothetical physiological processes within the central nervous system.

Hunt (21) emphasizes a difference in susceptibility to inhibitive processes in drawing the lines for his classification of people into those of erethitic type and kolytic type. The erethitic type possesses cortical excitability and the kolytic type is characterized by cortical inhibitability. He accepts the conclusions of Meltzer (35) that both excitability and inhibition are characteristic of living matter. Inhibition he sees as a suspension of physical activity. While processes of excitability and inhibition have a share in all neural functioning, individuals differ from birth in degree of excitability. These differences have been ascribed variously to differences in chemical, glandular and metabolic activities of obscure nature. Hunt himself postulates a specific cell which functions for inhibition. Those individuals who possess a preponderance of these cells form the over-inhibitive group, variously designated as schizoids, schizophrenics, and by Hunt as kolytics. A lack of these cells means over-excitability, and places the individual in the manic-depressive, cycloid group, called by Hunt erethitics. Hunt describes the erethitic as follows: "Great activity of mind and body. Responsive, impulsive, easily excited; quick-tempered, highly emotional and inclined to be restless. Mercurial; rash; hasty in action; psychic tempo is rapid; distractible, not easy to concentrate; more in reality; action and expression; friendly, sociable, accessible."

If one were seeking for investigation a single factor which might be a constituent of those broader differences subsumed under the term "constitutional type," variations in susceptibility to inhibition surely offer themselves as suitable. It is a factor which can be isolated as a psychological entity and which colors the whole personality in many situations occurring throughout the lifetime of the organism.

Individuals can be compared as to

the relative speed with which inhibitions can be conditioned. This comparison also offers a continuous range of quantitative measurement which may be contained between two extremes. If the position upon the scale of measurement of this function can be shown to be consistent within the experience of one individual, we are one step further toward the solution of the problem as to whether or not it is a constitutional trait. Its measurement permits classification and if it should prove to be inborn it could be accepted as one temperamental trait, and an ingredient in a future group classification.

Theories as to the physiological mechanism of inhibition are numerous, but not relevant to our own primary problem, which is the demonstration of individual quantitative differences in the ease with which inhibitions are set up, and the basic consistency of these differences within the temporal experience of these individuals. The term "inhibition" itself has been used in various connotations: The Freudian use of the term refers primarily to conduct and incapacity. Used by Pavlov and those of the Russian school and their followers in other countries, the term refers to a neuro-psychological process set up under experimental conditions clearly defined by them. It is used widely among those writing in the field of social psychology and sociology as applied to self-restraint of conduct with special reference to its social acceptability. The term is also used in connection with the phenomena of memory and forgetting, and experiences which cannot be recalled are said to be inhibited. In all of these varied uses, there is a common core of meaning which perhaps may best be described by the word "stopped." As the term is used in connection with our own experimental work herein reported, we understand it to mean a delay or cessation of activity in the face of conditions which have previously called out the activity and which remain sufficiently uniform to justify the expectation that the activity would remain uniform; said delay or lack of activity being explicable only in terms of factors internal to the acting organism.

Method

In devising our own technique for attacking this problem, we sought for an inhibition which could be conditioned under experimental conditions applicable to children of a wide age range. These experimental conditions also had to permit sufficient variability in the conditioning of the inhibition to disclose the types we were seeking, if they existed. This necessarily meant that we use an experimental situation which would result in a conditioned inhibition only if the internal situation of the subject were favorable to such conditioning. In preference to the unconditioned stimuli setting up strongly inhibitory reactions, such as electric shocks, etc., we purposely chose a situation which would have a weak tendency to condition an inhibition. The new conditioning in an experimental setting of a verbal inhibition already established seemed the best instrument for this purpose. It had a disadvantage in that it could only be used with children who had reached an age at which we could depend upon the verbal inhibition having been established. The verbal inhibition seemed to meet the requirements in all other ways so completely that we accepted this disadvantage and undertook to work out an experimental setting for the conditioning to a new stimulus of an inhibition previously conditioned to verbal commands.

We used a "Marietta" reaction time apparatus which offered as a stimulus for the pressing of a button either a white light, a green light, a red light or a buzz. The subject's reaction time was measured in hundredths of a second by the chronoscope belonging to the Marietta instrument, and recorded immediately on a chart. This reaction time apparatus has a screen between experimenter and subject, which allowed two experimenters to work behind it unseen by the subject. One experimenter manipulated the switches which controlled the stimuli and the other read and recorded the chronoscope readings.

The apparatus is furnished with two response keys, only one of which was used. The subject was always left free to make a choice as to whether to use the right or left hand for response pressure.

A fixed series of stimuli presentations was made up in advance. These series varied in internal sequence and length with different groups of subjects and the series used with each group will be presented in its turn. In each series there was one type of stimulus to which the subject was told not to respond at all. Unknown to the subject, this stimulus for which the inhibition was established verbally was always preceded by the same stimulus chosen from the other two lights. Green was usually the color for which response was omitted by instruction. If white were chosen for the other color it always appeared before the green and if red were chosen it always appeared before the green. By placing one color uniformly in the position which immediately preceded a color for which we had established an inhibition through verbal instructions, we hoped to condition this inhibition to the precedent color. Therefore, the color which preceded the green in any given series is referred to as the conditioned color. Except for the green and the conditioned color the reaction time stimuli were arranged for each series in an eccentric sequence. Both adults and children were used as subjects. The instructions were the same for both.

When the subject was seated before his side of the apparatus he was told by the experimenter: "Let's use this one here" (indicating which response key was to be used). "Now we want you to watch this opening. When you see a red light in there, then we want you to press down on this just as quickly as you can after you see the light." At this time the second experimenter showed a red light and the subject responded. The same procedure was used for the white light and the buzzer, and for the green light except that the subject was told not to respond to the green. After these instructions had been given the experimenter said, "All right, now we are going to do some more. Remember that you press down for red light, the white light, and the buzz; but not for green."

RESULTS

Experimental Series No. I

The object of this experimental series was to discover whether, under the conditions set up, the inhibitions established verbally to the green stimulus would be conditioned to the color which always preceded green. We were also interested to know whether this would happen in every case in the same degree, or whether there would be enough variation to permit the formulation of a measuring scale including some cases where the inhibition was not conditioned at all. These latter cases would represent the zero of the measuring scale.

Method of scoring. In this experimental series, all reaction times to all the stimuli were recorded as they were measured by the chronoscope in hundredths of a second. Because we were interested in comparing the effect of the experimental conditions on the reaction time of individuals, and not interested in comparing absolute reaction times, we calculated for each series the difference between the initial reaction time for a given type of stimulus and each subsequent reaction time for that type of stimulus. If a subsequent reaction time were larger than the initial one, we called the difference a positive difference; if a subsequent reaction time were smaller than the initial reaction time, we called the difference a negative difference. For instance, if the first reaction time to white were 82, then the differences between 82 and all the other reaction times to white in a series as given to one individual at one sitting would be calculated and arranged on a chart in the order of their presentations in the series, the positive differences being placed above a zero line, and the negative differences below. Opposite the beginning of the zero line was noted the absolute initial reaction time. This method of recording made it possible to make comparisons of the progress of the reaction time (whether it grew longer or shorter) in the case of the different types of stimuli used for any one individual in one sitting, and in the case of the same type of stimulus used with different individuals.

One hundred ninety-eight stimuli comprised each series presented in this experimental group. The following sequence was repeated six times to form the series: white, green, buzz, white, green, red, white, green, buzz, white, green, red, buzz, white, green, buzz, white, green, red, buzz, red, white, green, red, white, green, red, buzz white, green, buzz, white, green. In this sequence white invariably preceded green, and was the conditioned color. There were 84 subjects in this group. Most of them were college students; a few were members of the faculty; and ten were children.

The progress of the reaction times for each type of stimulus and for each individual, as shown by the differences between initial reaction time and subsequent reaction times to the same type of stimulus, was plotted in graph form for purposes of comparison. It became evident from a study of the graphs that the majority of the reaction times increased in length toward the end of the test. However, the increase in the case of the conditioned color (that color which invariably preceded green) was greater than the increase in the case of the other stimuli. A statistical evaluation of the increasing length of the reaction time in the case of each kind of stimulus was made as follows: the number of spaces above the zero line for each response to white, to red, and to the buzz, was counted; these were totaled. averaged and recorded for each stimulus. The correlation between the conditioned color and the non-conditioned color was .05. The correlation between the conditioned color and the buzz was −.067. The correlation between the non-conditioned color and the buzz was −.45. We interpreted this to mean that the behavior of the conditioned color differed more from that of the non-conditioned color and from that of the buzz than the behavior of the non-conditioned color and that of the buzz differed from each other. These results suggested the possibility that the reaction times to the conditioned color were being affected by its position which invariably immediately preceded the green.

The procedure outlined was repeated with a different group of 37 subjects, again chiefly composed of college students and members of the faculty. The stimulus sequence presented to this group was exactly like that presented to the former group, except that the red and white were interchanged. This placed the red in the position of the conditioned color, invariably preceding green. The statistical results for this group were as follows: the correlation between the conditioned color and the non-conditioned color was .16; the correlation between the conditioned color and the buzz was −.15; the correlation between the non-conditioned color and the buzz was −.31. Again we found that the difference in behavior between the conditioned color and either the non-conditioned color or the buzz was greater than the difference in behavior between the non-conditioned color and the buzz.

A comparison of the two groups shows that the behavior of the conditioned color as related to that of the other stimuli was similar, whether red or white occupied the position invariably preceding green. From this we inferred that the unusual lengthening of the reaction time for the conditioned stimulus in the course of any given series was due to its position preceding the stimulus to which we had verbally set up an inhibition. In the case of the buzz we found that it had a startling effect which made its character as a stimulus differ so much from that of the colors that we did not attempt to compare it directly with the colors as a conditioned stimulus.

When we combined the results of both groups, we obtained the following statistical results: correlation between the conditioned color and the non-conditioned color, −.10; correlation between the conditioned color and the buzz, .077; correlation between the non-conditioned color and the buzz, −.34.

A further analysis of these results was made to establish corroborative evidence in favor of the inference that the behavior of the conditioned color varied from that of the other stimuli and that this variation was attributable to its position preceding green. The results of this analysis were as follows:

	cases
Conditioned red lengthened more than non-conditioned white	29
Conditioned red lengthened less than non-conditioned white	7
Conditioned white lengthened more than non-conditioned red	20
Conditioned white lengthened less than non-conditioned red	13
Conditioned red lengthened more than buzz	32
Conditioned red lengthened less than buzz	5
Conditioned white lengthened more than buzz	27
Conditioned white lengthened less than buzz	6
Conditioned white increases from starting point	25
Conditioned white decreases from starting point	8
Conditioned red increases from starting point	31
Conditioned red decreases from starting point	55
Non-conditioned white increases from starting point	20
Non-conditioned white decreases from starting point	16
Non-conditioned red increases from starting point	20
Non-conditioned red decreases from starting point	13
Conditioned color increases from starting point	56
Conditioned color decreases from starting point	13
Non-conditioned color increases from starting point	40
Non-conditioned color decreases from starting point	29
Buzz increases from starting point	15
Buzz decreases from starting point	54
Conditioned red increases as non-conditioned white decreases	14
Conditioned red decreases as non-conditioned white increases	3
Conditioned white increases as non-conditioned red decreases	9
Conditioned white decreases as non-conditioned red increases	3
Buzz and non-conditioned white decrease as conditioned red increases	10
Buzz and non-conditioned red decrease as conditioned white increases	6
Buzz and non-conditioned white increase as conditioned red decreases	0
Buzz and non-conditioned red increase as conditioned white decreases	1
Buzz and non-conditioned color decrease as conditioned color increases	16
Buzz and non-conditioned color increase as conditioned color decreases	1
Buzz and conditioned red increase as non-conditioned white decreases	4
Buzz and conditioned white increase as non-conditioned red decreases	3
Buzz and conditioned red decrease as non-conditioned white increases	3
Buzz and conditioned white decrease as non-conditioned red increases	3
Buzz and conditioned color decrease as non-conditioned color increases	6
Buzz and conditioned color increase as non-conditioned color decreases	7
All decrease	5
All increase	6
Buzz increases as non-conditioned color and conditioned color decrease	1
Buzz decreases as non-conditioned color and conditioned color increase	28

It seemed clear that this experimental set up produced in some individuals a conditioned inhibition, as evidenced by increased length of the reaction time for the conditioned stimulus during the course of an experimental series. A study of the individual records for the members of these groups as they were presented in graphs indicated some individual difference in the behavior of the conditioned color, and our next step was to investigate the scope of this individual difference by repeating the experiment with large numbers of school children.

Experimental Series No. II

We had already found, in the course of Experimental Series No. I, that our sequence of 198 stimuli was longer than necessary. If a conditioned inhibition could be produced in a subject by this technique, the fact became evident during the first sixth of the series. For a part of Experimental Series No. II we used the original series sequence of 198, which presented the conditioned color 30 times; during the latter part of Experimental Series No. II we shortened the stimulus sequence to 33, which presented the conditioned color ten times before the color green. The same sequence was used that was used in the longer series. Comparisons, which will be given later, between the results of the long and short series, showed that the short series which included ten presentations of the conditioned color, was as effective as the long series of thirty presentations of the conditioned color, in producing a conditioned inhibition.

Throughout the work with the subjects in Experimental Series No. II, red and white were used interchangeably and at random as a conditioned color. Otherwise the stimulus sequence was always the same.

Because the objective of Experimental Series No. II was the investigation of the range of individual differences in the behavior of the reaction times for the conditioned color, we recorded and studied only the reaction times for the color which was being used as the conditioned color.

The subjects for Experimental Series No. II were children in two grade schools. We used the first three grades of one school and the last three grades of another. The apparatus was set up in the nurse's room at the school building, and the children were sent one at a time by the teacher from the school room to the nurse's room. Two experimenters worked with each child; while one experimenter presented the stimuli, the other read the chronoscope and recorded the reaction times to the conditioned color on a chart (see figure 1). The figures along the vertical edge of the chart refer to time. Each spacial unit represents a time interval of four hundredths of a second or forty sigma. The horizontal spacing represents the sequence of ten presentations of the conditioned color. The area above the zero line represents the amount of difference between the initial reaction time (measured in hundredths of a second) and the subsequent reaction time (measured in hundredths of a second) when the subsequent time is the greater. This is termed the positive difference. The area below the zero line represents the difference between the initial and subsequent reaction times when the subsequent time is the shorter, and is termed the negative difference. The initial reaction time is represented by the zero line. At the top of the page were also noted the name and age of the child, and the date of the experiment. Three hundred fifty-nine subjects were used.

The total number of differences between initial and subsequent reaction times for this series were plotted on one sheet of graph paper. Zones were established for these differences. The middle zone represented the area within which 50 per cent of the reaction time differences fell. This zone extended above the zero line, to points which lay between twenty-one and twenty-eight hundredths of a second for each presentation, and below the zero line to points which lay between fourteen and twenty-three hundredths of a second for each presentation. Twenty-five per cent of the difference times lay above this zone in the positive field, and 25 per cent lay below in the negative field. This middle zone may represent, then, the average area for difference times, and is represented by the shaded area on the chart (fig. 1). Individuals whose graphs fall within this area may be said to be making an average performance with this experimental set up. Those whose graphs fall in the positive area above this zone may be said to show an unusual capacity for conditioning an inhibition under these experimental circumstances. Those whose graphs fall in the negative area below the average zone may be said to have less than average tendency to the conditioning of an inhibition in this experimental set up.

When these zones were established the question naturally arose as to whether they represented a true differentiation between individuals, or the accidental grouping of a mass of difference times. Five individual graphs were chosen at random whose first reaction time differences following the initial reaction times were zero. Five others were chosen whose first reaction time differences after the initial reaction times lay between 0 and 10 above; five more were chosen whose first subsequent reaction time differences lay between 10 and 20 above zero; and so on until each group of ten hundredths of a second between 80 above and 80 below was represented by five individual graphs, according to the placement of the first reaction time difference following the initial reaction time. A study of these graphs showed that those individual records which originated within each of the three zones consistently maintained their zone placement. Table 1 gives the figures for these groups of individual records. It must be remembered that in all cases the reaction time figures represent differences between the initial time and subsequent reaction times as measured in hundredths of a second.

Our next step was to divide all the records into three groups according to the zones in which they originated, and to establish the medians for each zone as shown in figure 2, which shows the relation of the medians to the zones.

The records for Experimental Series No. II were also divided into age

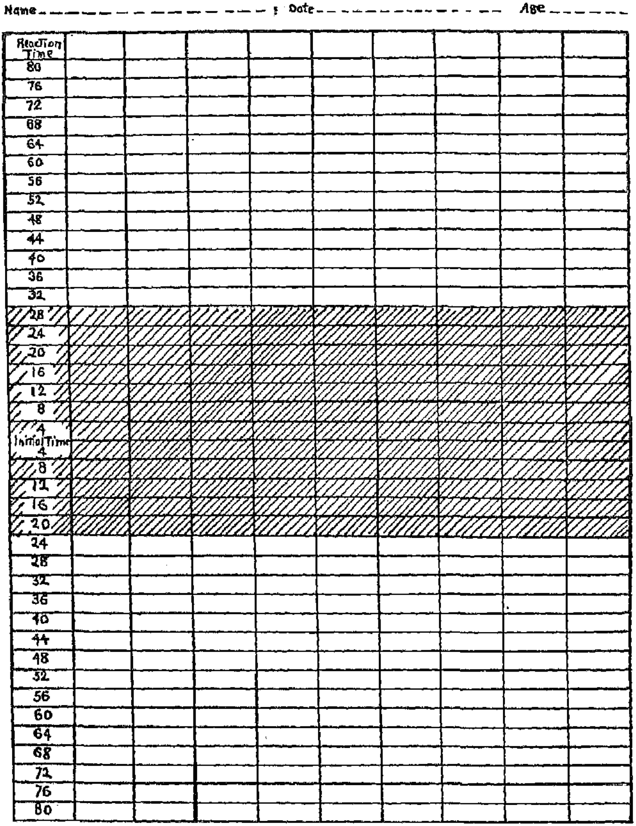

FIG. 1. RECORD CHART FOR REACTION TIMES FOR CONDITIONED COLOR

Numbers along the vertical edge of the sheet refer to time. Each spatial unit represents a time interval of four hundredths of a second.

The middle line marked "Initial time" represents the first reaction time for the conditioned color (zero line).

The horizontal spacing represents the sequence of ten presentations of the conditioned color.

The area above the zero line represents positive difference (see text). The area below the zero line represents the negative difference (see text).

The shaded area represents the middle zone or average performance (see text).

The area above shaded area represents an unusual capacity for conditioning of inhibition.

Area below shaded area represents less than average tendency to conditioning of inhibition.

TABLE 1

Individual reaction time records

RANGE OF THE REACTION TIME FOLLOWING THE ZERO REACTION TIME	UPPER LIMIT OF RANGE OF GROUP	LOWER LIMIT OF RANGE OF GROUP	REACTION NUMBER								
			2	3	4	5	6	7	8	9	10
80 to 70	+89	−15	79	27	28	41	49	5	13	16	3
			76	−3	−6	78	5	89	−3	77	71
			75	22	64	39	33	33	49	−3	48
			73	33	4	14	74	33	19	61	30
			71	−15	62	−14	68	53	64	60	60
70 to 60	94	15	65	49	89	73	63	15	89	70	50
			64	67	68	73	87	25	73	65	47
			63	17	29	93	78	24	40	31	32
			63	60	22	34	26	42	40	24	31
			62	25	94	27	77	42	59	48	62
60 to 50	97	1	55	9	38	52	39	27	17	38	32
			55	39	19	52	37	35	55	14	47
			54	34	97	60	40	58	37	37	25
			52	50	55	30	42	59	37	41	[illegible]
			51	29	23	36	18	38	1	24	29
50 to 40	59	−12	49	30	40	59	41	28	37	30	−1
			47	−12	43	9	−1	−11	17	23	−1
			45	21	20	17	15	46	28	28	−2
			42	32	44	36	11	52	41	49	49
			42	52	25	2	27	42	11	0	12
40 to 30	54	−25	38	29	−9	−14	20	6	23	8	−2
			36	42	17	11	32	20	25	15	27
			34	41	29	49	29	54	20	31	36
			32	31	31	33	28	25	24	23	26
			31	−8	4	45	−25	−6	−15	19	−15
30 to 20	48	−7	28	24	38	35	24	46	30	33	45
			27	23	20	27	37	24	34	13	0
			26	−6	24	31	48	−2	30	−2	16
			26	2	4	14	−2	31	9	24	6
			23	23	21	39	28	−7	23	20	3
20 to 10	32	−21	17	−19	−9	2	−18	−20	−10	−1	−17
			15	−15	−2	−10	−18	3	−21	−17	−16
			15	11	3	10	2	−6	16	6	−7
			15	13	24	5	−2	25	22	−17	−8
			10	24	7	9	14	14	17	29	32

TABLE 1—*Continued*

RANGE OF THE REACTION TIME FOLLOWING THE ZERO REACTION TIME	UPPER LIMIT OF RANGE OF GROUP	LOWER LIMIT OF RANGE OF GROUP	REACTION NUMBER								
			2	3	4	5	6	7	8	9	10
10 to 0	29	−22	7	12	20	15	10	29	10	−10	16
			6	13	23	23	12	20	24	25	18
			5	5	−1	4	5	−17	13	3	−22
			2	5	−1	21	−5	7	−9	−8	16
			1	19	18	23	1	16	9	20	1
0	+72	−72	0	2	−8	−3	−72	−1	3	−10	−6
			0	−11	−2	−9	−3	−8	−8	−14	−27
			0	−4	−11	13	−12	−21	−32	0	0
			0	0	0	65	65	15	72	15	60
			0	−6	−70	−10	4	−7	8	4	−8
0 to −10	28	−39	−1	−6	−4	−3	5	−3	11	8	0
			−2	3	−11	14	27	25	14	28	−39
			−3	19	−5	4	−4	−4	−4	−11	−1
			−7	−6	−14	−21	−26	−13	−12	−6	−12
			−9	11	−10	−17	17	10	−7	8	−13
−10 to −20	20	−45	−10	−24	20	9	−8	−8	−17	−5	−45
			−15	−19	−7	−19	−2	−23	−4	−16	4
			−15	−5	−7	−5	−9	−11	2	8	−1
			−16	−22	7	7	−27	−6	−16	−7	−3
			−17	−17	−41	−15	−7	−8	−19	−22	−11
−20 to −30	19	−76	−20	−25	−29	−9	−16	−18	−30	−39	−16
			−20	−10	−5	−7	−10	13	3	−15	0
			−23	−16	−3	−56	19	−76	7	−67	14
			−27	−53	−30	−44	−27	−51	−32	−25	−12
			−29	−9	−7	−17	−26	−2	−19	−30	−49
−30 to −40	4	−159	−31	−40	−43	−41	−41	−45	−51	−57	−24
			−34	−9	−19	−76	−69	4	−9	−40	−27
			−36	−32	−27	−12	−21	−17	−21	−35	−30
			−36	−93	−106	−13	−92	−26	−73	−113	−63
			−39	−47	−56	−56	−70	−153	−132	−155	−159
−40 to −50	6	−81	−42	−50	−65	−40	−33	−56	−48	−42	−27
			−43	−39	−46	−35	−54	−54	−51	−59	−62
			−44	−35	−38	−49	−45	−45	−53	−30	−41
			−45	−81	5	6	−45	−3	−4	5	−30
			−48	−57	−55	1	−75	−75	−75	−10	−71
−50 to −60	30	−65	−51	−31	−64	26	−56	−52	−8	12	0
			−51	−45	−51	−15	−12	−38	−30	−48	−55
			−52	−65	−53	−60	30	−60	−60	−65	−60
			−57	−20	−60	−59	−58	−61	−4	−14	3
			−60	−39	−28	27	−51	−46	1	30	−56

TABLE 1—*Concluded*

RANGE OF THE REACTION TIME FOLLOWING THE ZERO REACTION TIME	UPPER LIMIT OF RANGE OF GROUP	LOWER LIMIT OF RANGE OF GROUP	REACTION NUMBER								
			2	3	4	5	6	7	8	9	10
−60	20	−80	−61	−65	11	14	11	−59	−55	−33	17
to			−63	−72	−8	11	15	13	−63	−54	12
−70			−67	−76	−80	−18	−15	7	10	4	3
			−70	−1	−71	−68	12	−79	−80	−53	−41
			−70	−68	−7	15	14	−79	2	17	20
−70	19	−100	−73	3	−82	−15	19	−82	3	−1	−26
to			−74	−4	−20	−74	−64	−56	−82	−15	−13
−80			−76	−61	−69	−16	−5	−21	−54	−31	−69
			−78	−90	−8	−18	−100	−39	−94	−24	−4
			−78	−6	−8	−98	−18	−14	−91	−13	−15

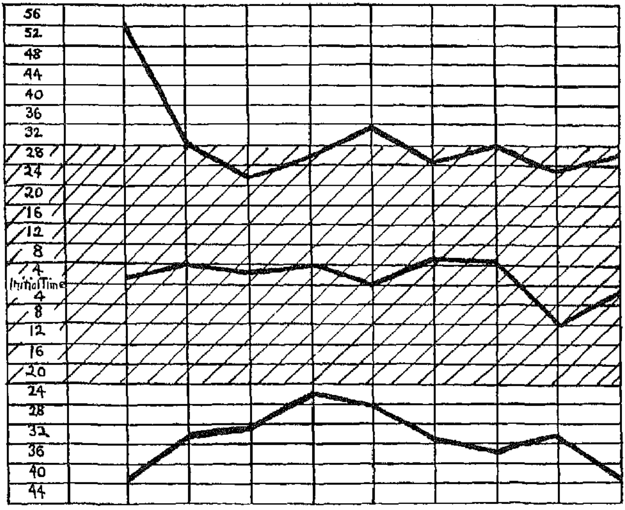

FIG. 2. MEDIANS FOR RECORDS ORIGINATING IN EACH OF THE THREE PERFORMANCE ZONES

Shaded area represents zone of average performance. Area above shaded area represents unusual capacity for conditioning of inhibition. Area below shaded area represents less than average tendency to conditioning of inhibition.

Figures at vertical edge of record sheet represent time intervals in hundredths of a second. Horizontal spacing represents the sequence of presentations of conditioned color.

Graphs are plotted in terms of differences between initial reaction time to conditioned color and subsequent reaction times to conditioned color.

groups. The correlation between age and amount of conditioning for children within school grades one to six was −.25, which is not enough to indicate any effect of training upon the susceptibility to the conditioning of inhibition under these experimental circumstances.

It has already been noted that in part of the experimental series with the school children we used a smaller number of stimuli than was used in the Experimental Series No. I, which established the fact that it was possible to produce a conditioning of inhibition under these experimental conditions. The validity of the short series as an index to the susceptibility of a given individual was established in the following manner. Only the results for those individuals to whom the full series of 198 stimuli was given were used for this computation. First, the average difference between the initial reaction time for the conditioned color and the first nine subsequent reaction times for the conditioned color was calculated for each individual and designated positive or negative according to whether it was above or below the zero line. This average will be referred to in the future as the "partial average." Second, the average difference between the initial reaction time and all thirty-two subsequent reaction times was calculated for each individual and designated positive or negative. This will be referred to in the future as the "total average." Third, in those cases in which both averages (the partial average and the total average) were either positive or negative we calculated what percentage the partial average was of the total average. The final average of these percentages was 103.3 per cent. This means that the average amount of difference between the initial reaction time and the first nine subsequent reaction times for the conditioned color is 103.3 per cent of the average difference between the initial reaction time and all of the subsequent reaction times. In other words, as much or more conditioning of the inhibition takes place during the first nine subsequent repetitions of the conditioned stimulus as takes place in the course of thirty-two repetitions. In 91 per cent of the cases the partial difference and the total difference were in the same direction. In 90 per cent of those cases in which the partial and total differences were in opposite directions the total graph for the individual remained entirely within the middle zone. These cases were individuals whose curves lay so close to the zero line that the crossing back and forth between positive and negative could not detract from the validity of the first nine subsequent reaction times as an index of the zone placement. Only in the case of one individual did the partial and total differences vary in such a manner as to give different zone placements for the partial and total results.

The fact that the zone placement for individual graphs is in the main consistent with the zone placement of the first subsequent reaction time, and the fact that a series of 9 subsequent reaction times constitutes a valid basis for zone placement of an individual, are in line with the current disposition to believe that conditioning takes place with one repetition, if at all.

In connection with Experimental Series No. II we were also interested to know whether index as to zone placement of the individual could be furnished by the initial reaction time. On the basis of our previous results we assumed the first subsequent reaction time to be an index of zone placement, and computed the correlation between the initial reaction time and the first subsequent reaction time for the conditioned color. The correlation was —.13, indicating that the absolute speed of motor reaction is not an index of the susceptibility of the individual to the conditioning of inhibition under these experimental conditions. The individual who is impulsive in his movements, physically "quick on the trigger," and rapid in his absolute reaction time, is not necessarily the excitable type of individual in the sense that he lacks average capacity for forming conditioned inhibitions in this experimental situation.

Experimental Series No. III

This series was undertaken to obtain data bearing on the degree of consistency of results with this experimental technique for a given individual during a series of repeated tests extending over a period of time. For subjects we used a group of 10 college students—9 girls and 1 boy. Each of these 10 subjects was given repeated tests with intervening time intervals of three days to three weeks. The progress of the time intervals was kept as nearly uniform as possible for the ten subjects.

In order to minimize practice effect during these repeated tests we used each of the 3 colored stimuli (white, red and green) only twice as the conditioned color. Because the non-conditioned color could conceivably be weighted with a practise effect in the direction opposed to the conditioning of an inhibition we arranged the series in such a manner that the non-conditioned color for each series was the conditioned color for the next series. The following table shows the rotation of the colors:

	SERIES NUMBER					
	1	2	3	4	5	6
Conditioned color	W	R	G	W	R	G
Verbally inhibited color	G	W	R	G	W	R
Non-conditioned color	R	G	W	R	G	W

The results of the repeated tests for these ten subjects are presented in table 2. It will be observed that in the main the results of the repeated tests for any given individual show a high degree of consistency with regard to zone placement.

We were fortunate in being able to repeat this test in February of 1934 with 17 of the school children who had taken the test in the fall of 1931. Because of the great time interval we assumed there would be no appreciable practise effect carried over to the second test and used the identical stimulus sequence used in the first test, thus making the two tests directly comparable. The comparison of the results of the first test with those of the second test for each child are presented in table 3.

We were also able to repeat the experiment with seven of the original

TABLE 2

SUBJECT	DATE	REACTION NUMBER								
		2	3	4	5	6	7	8	9	10
1	Nov. 24	−9	−25	−18	−16	−21	−23	−24	−30	−29
	Nov. 29	50	49	−29	50	52	51	50	−14	−1
	Dec. 5	37	31	15	2	−14	−18	−11	−19	−16
	Dec. 8	−40	−62	−45	−50	−47	−55	17	−54	18
	Dec. 15	−18	−7	−11	−16	0	7	0	−6	−12
	Jan. 5	−3	3	−7	−7	−7	−8	−31	2	−7
2	Nov. 24	−19	−9	−29	−21	−21	−19	−16	−17	−17
	Nov. 29	−6	−6	16	4	1	−11	−16	−11	1
	Dec. 5	69	54	33	51	49	32	17	42	35
	Dec. 8	−22	−26	−56	−33	−32	−40	−24	−18	−35
	Dec. 15	−1	−22	−29	6	8	1	−5	6	−9
	Jan. 5	−1	1	1	1	−5	0	1	1	1
3	Nov. 24	−9	17	35	14	16	25	34	24	24
	Nov. 29	7	6	10	−2	17	29	50	45	2
	Dec. 5	−33	2	3	−18	−15	−39	−20	2	−4
	Dec. 8	−4	43	4	−26	−7	−23	4	1	20
	Dec. 15	11	20	12	22	8	25	14	21	27
	Jan. 5	−4	−17	−9	−1	5	4	−9	−11	−10
4	Nov. 24	0	4	−5	5	−8	−14	−14	−3	−6
	Nov. 29	13	−16	−7	57	56	−27	10	8	−36
	Dec. 5	−8	33	47	19	6	−3	35	−21	10
	Dec. 8	−3	−4	11	−4	−12	20	19	32	9
	Dec. 15	−20	−26	−10	−22	−3	30	−10	41	−11
	Jan. 5	13	22	32	25	49	56	49	40	61
5	Nov. 24	−30	−24	−19	−29	−26	−24	−24	−30	−30
	Nov. 29	−30	65	11	13	63	63	23	17	1
	Dec. 5	−12	−8	25	23	9	−10	−21	−13	−16
	Dec. 8	2	16	6	8	8	6	12	29	87
	Dec. 15	−3	−9	6	13	5	4	7	−3	−3
	Jan. 5	−15	−23	19	−1	1	−6	5	28	43
6	Nov. 29	−48	−71	−57	−18	−16	21	−5	−15	15
	Dec. 5	25	−14	−19	−28	−40	−19	−33	−32	−29
	Dec. 11	−28	−22	−17	−21	−19	−17	−14	−26	—
	Dec. 19	−19	−60	−62	−75	−55	−54	−27	−51	−52
	Jan. 12	−3	−10	−11	−13	−22	1	−3	−7	−5
7	Nov. 29	−1	−42	−70	2	−1	1	−34	1	−46
	Dec. 5	28	14	18	12	13	28	17	14	20
	Dec. 11	14	−1	−20	0	49	15	49	4	−28
	Dec. 19	−12	−29	−25	−43	−4	−22	6	−26	−24
	Jan. 12	7	14	4	10	10	14	8	6	8

TABLE 2—*Continued*

SUBJECT	DATE	REACTION NUMBER								
		2	3	4	5	6	7	8	9	10
8	Nov. 29	27	19	62	56	25	31	24	45	15
	Dec. 4	4	−15	−1	4	−16	6	−3	−2	7
	Dec. 9	−15	29	19	0	17	40	22	39	46
	Dec. 12	−7	19	−2	−3	1	8	8	20	−21
	Dec. 19	−8	2	−24	11	−10	5	−27	6	5
	Jan. 12	6	30	−3	13	−10	15	−15	31	24
9	Nov. 29	−7	2	−27	−17	−43	−39	−52	−8	−20
	Dec. 4	6	7	−24	3	13	−1	16	5	19
	Dec. 9	0	18	14	−5	−9	−20	31	−10	1
	Dec. 14	−8	−6	−13	−17	−9	1	1	7	−8
	Jan. 12	−11	−16	−60	−21	−22	−13	2	−5	6
10	Nov. 29	−19	−31	−17	−8	7	−17	−17	−17	−7
	Dec. 4	39	19	20	32	76	11	20	11	−6
	Dec. 9	69	40	68	68	13	−3	18	69	20
	Dec. 16	17	12	13	20	13	22	46	9	17
	Jan. 12	18	18	23	82	72	38	28	17	37

college group who had taken part in Experimental Series No. I in the fall of 1930. For these subjects we used the same stimulus sequence for the two tests, assuming there would be no appreciable practice effect over such a long time interval. The results of the first test compared with those of the second test for each of these individuals are presented in table 4.

DISCUSSION OF RESULTS

The progress of results through the 3 experimental series indicated that in this type of experimental set up an inhibition could be conditioned and that variations appeared among our subjects whom we were able to condition under these circumstances. We found no instance where the response to the conditioned color was completely inhibited. The conditioned inhibition consisted only in delay of response. The amount of this delay varied for different subjects, but did now show wide variations for the same subject at different times. The character of these variations permitted a classification of our subjects into groups according to the amount of delay they experienced.

Inhibition to the conditioned color as evidenced by delayed response under these experimental conditions may be described as behavior manifesting constitutional type, because: first, it permits classification; secondly, it is presumptively inborn because it is not influenced by age, training, or previous experience with the same experimental set up; thirdly, it is related to a factor which affects the adaptive responses of the individual in many situations throughout a lifetime.

An analysis of the results shows that our zero, or the total lack of any

TABLE 3

SUBJECT	DATE	REACTION NUMBER								
		2	3	4	5	6	7	8	9	10
1	Nov., '31	−31	−40	−43	−41	−41	−45	−51	−57	−24
	Feb., '34	52	−2	−15	−2	4	2	17	−1	−12
2	Nov., '31	17	−19	−9	1	−18	−20	−10	−1	−17
	Feb., '34	40	0	−16	−42	−21	−23	−27	−19	−57
3	Nov., '31	15	13	24	5	−2	25	22	−17	−8
	Feb., '34	58	101	18	8	4	33	−6	2	−9
4	Nov., '31	10	24	7	9	14	14	17	29	32
	Feb., '34	20	1	29	−1	23	13	13	29	11
5	Nov., '31	−1	−6	−4	−3	5	−3	11	8	0
	Feb., '34	−2	13	4	−3	0	−6	−4	—	—
6	Nov., '31	−16	−22	7	7	−27	−6	−16	−7	−3
	Feb., '34	65	18	24	22	0	−22	−22	23	10
7	Nov., '31	40	−15	0	0	−35	−5	−45	10	6
	Feb., '34	0	−37	−13	−10	−3	−17	−18	−33	−31
8	Nov., '31	31	7	−23	−12	−2	2	−4	−9	−17
	Feb., '34	−20	−23	−15	−22	14	−6	12	14	−5
9	Nov., '31	−4	−6	−3	21	13	106	96	−14	−4
	Feb., '34	8	5	30	−2	5	−1	−8	−10	−16
10	Nov., '31	−11	9	−14	2	−71	3	−9	−81	−11
	Feb., '34	2	15	−20	4	−3	−6	9	1	−3
11	Nov., '31	−2	−14	−1	−54	−39	−54	31	−25	−5
	Feb., '34	−5	−38	−28	−40	−20	−38	−38	−27	—
12	Nov., '31	−20	−32	−12	−5	−12	5	−6	−6	−24
	Feb., '34	−8	−5	1	−23	−29	−12	−1	−1	—
13	Nov., '31	−2	3	−2	3	0	−2	−1	9	−8
	Feb., '34	7	−4	−12	−2	−5	−12	−4	−5	−2
14	Nov., '31	−20	−10	−5	−7	−10	13	3	−16	0
	Feb., '34	−16	−15	−20	−20	−13	−9	−14	−9	−1
15	Nov., '31	−1	3	8	−2	5	5	22	6	−2
	Feb., '34	9	3	−7	3	18	3	−3	−4	2
16	Nov., '31	−43	−39	−56	−35	−54	−54	−51	−59	−62
	Feb., '34	−20	7	−36	−30	−15	−30	2	—	—
17	Nov., '31	−34	−9	−21	−76	−69	4	−19	−42	−27
	Feb., '34	−32	12	−33	−44	−37	−28	−27	−42	3

conditioned inhibition, delineates a group of subjects which is average but not an extreme group as opposed to those who exhibit an unusually strong conditioned inhibition. These experimental conditions disclose another group for which the conditioned inhibition not only fails to establish itself, but which shows a definite acceleration tendency in the response to the conditioned color. Like the conditioned inhibition, this tendency is shown in various degrees in different subjects and remains consistent for any one subject over wide time intervals. When we are measuring the reaction time differences of these subjects we are not only dealing with a group whose tendency to condition inhibition cannot be measured by this technique, but we also find we actually are measuring something else manifested by this group. We assume that this acceleration tendency represents the practise effect or the positive conditioning to the color which would normally take place were there no inhibitory factor counterbalancing it. If this is true the variations within this group disclose variations in capacity for degree of acceleration with practise.

TABLE 4

SUBJECT	DATE	REACTION NUMBER								
		2	3	4	5	6	7	8	9	10
1	Fall, '30	−65	−5	−14	−29	−13	−19	−3	−27	−35
	May, '34	−36	−42	−64	−47	−43	−36	−37	−48	−48
2	Fall, '30	14	43	22	32	120	−50	−2	5	57
	May, '34	44	64	37	25	49	55	34	25	32
3	Fall, '30	2	21	27	21	13	17	26	12	15
	May, '34	9	9	8	−8	−8	0	−12	3	−8
4	Fall, '30	−9	−1	−1	20	8	25	11	−1	5
	May, '34	−24	−10	−34	−27	−16	−19	−20	−14	−47
5	Fall, '30	−20	0	0	−10	−3	−10	−2	20	−5
	May, '34	8	11	15	12	−7	4	12	1	5
6	Fall, '30	10	5	−2	18	1	7	−1	5	−2
	May, '34	−4	4	11	6	−1	2	16	26	15
7	Fall, '30	6	28	18	6	15	26	13	10	18
	May, '34	4	8	2	3	8	13	7	−3	−1
8	Fall, '30	19	33	64	44	18	34	21	50	19
	May, '34	−6	−30	17	3	16	9	−15	8	−18
9	Fall, '30	22	32	37	31	22	15	27	19	—
	May, '34	13	4	−24	−3	−5	−12	0	3	3

Presumably, each person during one

experimental sitting was continuously subjected to 2 factors influencing the length of the reaction time in opposite directions: one, the acceleration factor of practice; the other, the delaying factor of the conditioned inhibition. If this be so, any one point upon the graph showing the progress of the reaction time to the conditioned color represents the degree of balance between these two opposing factors at that moment and at that place in the series; and the entire series graphically portrays a history of the relative efficiency of these two factors in influencing the reaction time of the subject.

For 50 per cent of our subjects this history is one of a continuous, smooth counterbalancing of these 2 factors with a slight preponderance in favor of the delaying factor (see median for middle zone, figure 2). For 25 per cent of our subjects this history shows a marked swing early in the series in favor of the delaying factor with a gradual pull exerted by the accelerating factor, which brings the balance between the two down toward what we have called the middle zone, but not sufficiently into it at any time to approach the median for the middle zone (see median for upper zone, figure 2). Similarly for 25 per cent of our subjects the accelerating factor causes a sharp decrease in time at the beginning of this history (see median for lower group, figure 2) with a later pull by the delaying factor which lifts the graph toward the middle zone, but again does not bring it near to the median for the middle zone.

We may characterize the subjects whose histories fall within the middle zone as individuals whose behavior under these conditions is almost equally balanced by inhibiting and accelerating factors. We may characterize the 25 per cent in the upper zone as individuals who are predominantly under the influence of the inhibiting factor, and we may characterize the 25 per cent in the lower zone as those who are predominantly under the influence of the accelerating factor. Occasionally we find an individual whose reaction time history apparently represents, not a simultaneous counterbalancing of these 2 factors, with one or the other consistently favored, but a rapid swing between the two, with one or the other completely dominating behavior at any given moment. Figure 3 shows the graph of such an individual. These latter subjects probably do not represent a mixed type, but a fourth type, whose behavior reflects not a continuous counterbalancing of these two factors, but an intermittent domination.

If, within the very narrow confines of the simplified conditions of this experimental set up, we find the progress of the reaction time portraying and to some extent analyzing the effects of these two component factors which are modifying the subject's behavior, the possibility presents itself that the so-called learning curve, established under much more complex situations, also represents such a history of counterbalanced factors. In such a case the interpretation of the curve would not have significance if interpreted solely from the point of view of its own internal relationships, but could only be significant insofar as the position of the curve at any one point could be related to the source of the component accelerating and delaying factors. In other words, in this experiment and in any experiment involving "learning," the objective results are probably always measuring two processes. In this instance the area above the zero line is

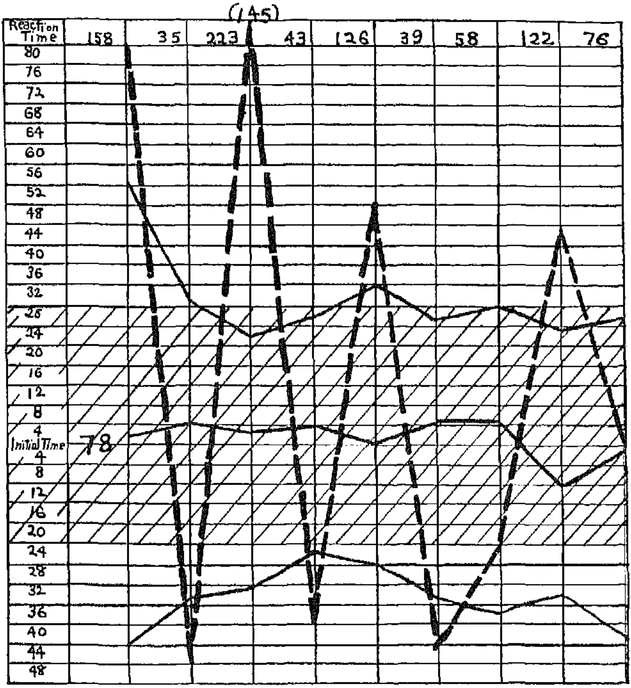

FIG. 3. RECORD FOR SUBJECT EXEMPLIFYING FOURTH TYPE SHOWING INTERMITTENT DOMINATION

Figures at vertical edge of record sheet represent time intervals in hundredths of a second. Horizontal spacing represents the sequence of presentation of conditioned color. The initial time for conditioned color for this subject was 78. Figures across top of the record sheet are the absolute reaction times for each subsequent presentation of conditioned color. Differences between initial time and subsequent times are represented by the broken line. Continuous lines represent medians determined for upper, middle and lower zones with which the record for this subject can be compared.

measuring a delaying process; the area below the zero line is measuring an accelerating process. For any measurement to be valid where such counterbalanced forces are at work producing objective results, a zero of some sort must be established, and the counterbalanced forces analyzed with regard to their relation to each other at any given moment.

The general behavior of an individual cannot be accepted as indicative of his placement in a classification of constitutional type involving rapidity of conditioning to inhibitions. Any child or adult may become through experience so strongly conditioned with inhibition of response or with a positive response to any sort of stimulus that his behavior in the face of such a stimulus is of no significance for his constitutional type placement. By the time a child is a few years old, his environment will be so filled with these stimuli that no ordinary set of circumstances can be depended upon as a guide to the nature of his constitutional type. This will be especially true if the circumstances of his life have favored the injection of frequent and strong emotional responses into his totality of adaptive behavior. The trend of these conditioned responses, formed through daily experience, may be such as to even simulate the extreme of one constitutional type when the child may actually be of the extremely opposite type. Social situations particularly will fail as indicators of constitutional type, and laboratory test situations which involve a large proportion of social contacts might give results in which the nature of the constitutional type would be obscured by conditioned responses to stimuli inherent in the social contact itself.

The reliability of the test for constitutional type, then, will be in direct proportion to the degree in which it is withdrawn from situations to which the individual is accustomed to adapt, to the degree of paucity of stimuli originating in social contacts, and to the amount of novelty in the total situation. Only in the novel situation is the child freed from obscuring cues to well-established conditioned behavior and constitutional type demonstrated with clarity.

In making clinical application of the results of this test, we find clearly apparent this discrepancy between objective test results and the inference drawn from the general character of the behavior of the child. We do, however, find a close correspondence between the objective results of the test and the rapidity of the response of the child to remedial programs. Those children who could be classified in the middle or lower zone on the basis of their behavior during the reaction time experiment responded rapidly to programs undertaken to help them in the overcoming of emotional and personality maladjustments. The children who were classified as belonging in the upper zone, when they were given this test, made slow response to remedial programs. The following instances will illustrate this point:

"A" was referred to the Laboratory because through one entire term and part of another in kindergarten she had never been known to speak, either on the playground or in the school room, although she chattered freely, intelligently and intelligibly in the home. The case history showed the gradual development of a sibling problem. "A" was one of the younger members of a large family of children; the oldest child was a girl; "A" was a girl; all the rest were boys. At the time of "A's" birth, the older sister announced that she had prayed for a little sister, her prayer had been answered, and the rest of the family could make up their minds to have nothing to do with the baby. From that time forth she took entire charge of the baby, caring for her, keeping her in her own room, and completely mothering and dominating her. When "A" started to kindergarten and it was found that she was too shy to speak, the older sister made frequent visits to the school room to inquire of the teacher if "A" had spoken yet. A remedial program involving devices to condition "A" more favorably to the school situation and also a readjustment of the emotional situation in the family field through the coöperation of the mother and older sister were undertaken. Although this program was eventually successful, "A's" response was very slow. It was six months before "A" became sufficiently well adjusted to talk and recite freely in the school situation. A year after this adjustment had been arrived at, "A" was one of the schoolroom subjects who took part in Experimental Series No. II. The objective results lay in the upper zone, indicating that she was persistently dominated by the delaying factor. Her individual graph is shown in figure 4 (Subject "A").

"B" was referred to the Laboratory by her mother and the school teacher, because of disciplinary trouble in school. "B" was very fidgety, and showed much hyper-activity. Her attention could not be held on any one thing for very long. The teacher felt that she was competent, but too flighty to be able to adjust well to the school routine. During the entire period of the examination in the Laboratory, her whole behavior was that of the hyper-active, excitable sort of child. We were surprised to find that the reaction time results gave a placement in the upper zone. Her problem was emotional, involving a certain amount of neglect by a young, well-to-do and socially inclined mother. The mother was intelligently coöperative and "B" reached a wholesome adjustment, but this was only after a number of months. After this adjustment was reached, however, all the hyper-activity and signs of over-excitability disappeared entirely, and "B" developed a stable type of adaptive response in social situations. For her reaction time record see figure 4, Subject "B".

"C" was brought into the Laboratory by her mother because of her very timid and reserved behavior with other children and with adults. Her mother described her as painfully shy, unable to make recitations in school, over-fond of reading, spending most of her play-time in lonely activity and in every way a withdrawn and shut-in personality. We were prepared to guess from the general picture which the mother drew and from the behavior of the child during general laboratory examination, that a reaction time test would show her zone placement to be that of the upper group. We were surprised to find, when we actually made the test, that it fell squarely in the middle zone. "C" was the child of missionaries to China. Her family had been involved in war and rebellion in that country and there had been harrowing experiences with escape from the fighting zones.

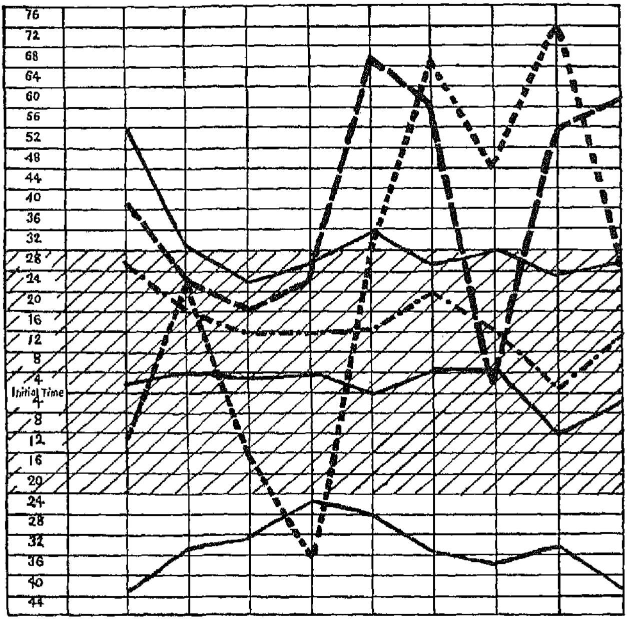

FIG. 4. RECORDS OF SUBJECTS BROUGHT INTO THE WICHITA CHILD RESEARCH LABORATORY FOR CLINICAL EXAMINATIONS BECAUSE OF BEHAVIOR PROBLEMS

Short interval broken line represents performance of Subject A (see text). Long interval broken line represents performance of Subject B (see text). Dash dot line represents performance of Subject C (see text). Continuous lines represent medians established for upper, middle and lower zones with which the three individual records for the three subjects can be compared.

Figures at the vertical edge of the record sheet represent time intervals in hundredths of a second. Horizontal spacing represents the sequence of presentation of conditioned color.

Graphs are plotted in terms of differences between initial reaction time to conditioned color and subsequent reaction times to conditioned color.

The parents had followed the policy of avoiding all discussion of these experiences with the child and attempting to have her forget it all as quickly as possible. The behavior difficulties had developed upon her return to the United States and her attempt to participate in school routine here. A program of emotional readjustment to her own experience in China was undertaken with "C", and the parents guided in a more wholesome attitude toward the child's problem as it related to these experiences. "C" made a very rapid adjustment. Subject "C", figure 4, shows the objective results of the test with "C".

These few illustrations serve to show the impossibility of predicting the child's zone placement from any observation of general behavior in the ordinary social situation, but indicate the possibility of the use of the objective test as an aid in judging the chances of rapid or slow response to remedial programs.

SUMMARY

1. It is possible, under the experimental set up described, to produce in some individuals a quantitatively measurable conditioned inhibition.
2. This conditioning occurs early in the test if at all.
3. The objective results obtained under this experimental set up are indicative of a tendency in most of the subjects to be dominated by either delaying or accelerating factors or to be equally influenced by these two factors throughout the test period. These may be termed hyper-inhibitive (delayed type), hypo-inhibitive (accelerated type), or balanced.
4. There is a possibility that a fourth kind of subject may represent a true type: the individual who is intermittently subject to domination by the two extreme factors. This may be termed an intermittently-inhibitive type.
5. Statistical treatment of the objective results of this test indicate that they are not influenced by age or training.
6. The absolute reaction time is not indicative of type.
7. The objective results remain consistent in character for a given individual throughout different tests performed after both long and short time intervals.
8. The objective results seem to represent the status at a given moment of the relation between counterbalancing factors, a factor which is delaying response and a factor which is accelerating it.

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Physical Measurements of Mexican Children in American Schools

H. T. Manuel

IT IS the purpose of this paper to report certain physical measurements of Mexican children in American schools. The problem arises in the practical situation in which one wishes to interpret measurements of Mexican children by reference to commonly used tables like the Baldwin-Wood height-age-weight tables. *A priori* one questions whether these tables are well adapted to use with children of a racial group and a geographical location different from that on which they were based.

There are two main elements in the racial derivation of Mexican children—white (largely Spanish) and Indian. But this mixture is by no means homogeneous throughout the population. On the contrary, individuals vary all the way from pure white to pure Indian. It would be of considerable anthropological interest to record measurements by races. Separation into races, however, would be an enormously difficult if not impossible task. Moreover, the differences within a race are usually greater than the differences between races. Furthermore, it was our purpose to contribute to the solution of the practical problem of dealing with a population defined on other than racial grounds. We desired to make no distinctions within the group except those which could easily be made. Skin color, which incidentally seemed to be the most useful of the anthropological measurements used by Paschal and Sullivan (4) as an index of Indian blood, was used as the only basis for anything approaching a racial classification.

PROCEDURE

Our measurements were made in the elementary schools of El Paso and Laredo, Texas, in the spring of 1930. In each city a staff of workers was recruited and instructed in making the measures desired.[1] In general, each worker specialized on one or two measures, but there was a little overlapping of work, and a few measures were made by the writer.

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[1] The writer is indebted to Superintendent A. H. Hughey and Assistant Superintendent W. A. Stigler, of El Paso, and to Superintendent W. P. Galligan and Supervisors W. J. Lemoine, Mrs. Asher R. Smith, and M. B. Brown, Jr., of Laredo, as well as to numerous teachers, principals, and pupils, for coöperation in this program. The personnel of the main measuring groups was as follows: Mary Frances Hogan, Mrs. Margaret L. Feuille, Maryelton Benton, and Mrs. Gladys Carlock, of El Paso; Mrs. H. W. Johnston, Mrs. J. T. Hall, W. E. Haynes, Mrs. W. E. Haynes, and Mrs. W. J. Lemoine, of Laredo. Grateful acknowledgment is made of the financial assistance of the Fund for Research in the Social Sciences, of the University of Texas, in making these measures and preparing this report.

The particular measures used in this study were selected because of their theoretical bearing upon growth and nutrition, their relation to the work of other investigators, particularly Baldwin and Franzen, and the relative ease with which they could be made. The choice of measures was further restricted to those which could be made in mixed groups without the removal of clothing other than coats, sweaters, and shoes. Height, width of hips, width of shoulders, and chest depth were included as measures of skeletal size; weight and arm girth as possible indices of nutritional status and physical condition. At first, the girth of the chest was taken, but this measurement was abandoned in favor of chest depth because of the difficulty of getting a reliable measure within a short time. In the case of a few children the length and breadth of the skull was measured.

Additional data included skin color, age, grade, sex, and occupation of parent, and in some cases the part of Mexico from which the children or their parents had come.

Height was measured in inches. Record was made of the last quarter-inch passed. Shoes were removed for this measure. In the beginning the stadiometer connected with the weighing scales was used, but after a little while a rigid scale attached to a vertical screen or to a wall was substituted. A try-square was placed on the head of the child to indicate his height on the scale.

Width of hips and width of shoulders were recorded in centimeters and tenths. For these measures large wooden sliding calipers were used. The shoulder measurement was made to include the distance from humerus to humerus on the outside of the arm just below the acromion process. In the hip measures the major trochanters were located by palpation and the calipers adjusted to measure this distance. The hip measures and in many cases the shoulder measures were made over the clothing. After a number of actual measurements of clothing had been made, a scale for allowing for the thickness of the clothing was devised, and the allowances in individual cases were noted on the record form at the time of measurement.

Chest depth was measured by the Stoelting spreading calipers employed in skull measurements. Record was made in centimeters and tenths. One end of the calipers was placed over the sternum just below the depression between the ends of the two clavicles, and the other end was placed over the spiny process of the vertebra at about the same level. For a second measure the anterior end was moved slightly to one side and another reading was made. If the second measure differed much from the first, attention was directed toward remeasurement. The measurement in both positions was recorded.

Weight was measured by the ordinary beam scales used by physicians. Record was made of the last quarter pound passed on the beam.

Our work with arm girth soon showed the need for a convenient instrument to equalize tension on successive measurements. This was accomplished by an instrument devised especially for these measurements. It consisted essentially of two coiled steel tapes so mounted on a brass strip that the free ends could be attached to each other after one tape had been looped around the arm to be measured. When the tapes were thus arranged, the operator released the springs, and the tapes then pulled in opposite directions, thus controlling the tension automatically (3). Two measures were taken, one with the arm at right angles with the body and the forearm flexed back so that the fingers touched the shoulders and the other with the arm hanging loosely at the side.

Cranial measures were taken with the Stoelting spreading calipers.

Skin color was graded as light, medium, or dark on a scale made for the study. This scale was made by picking out three children who seemed to be typical of three stages of pigmentation and matching their colors as nearly as possible by means of painting water-color strips on paper. Miss Gladys Rupkey, art teacher, kindly made these color strips.

Only a part of the results obtained will be reported in this paper.

Reliability of measures

One who has worked critically in the measurement of school children knows that there are many sources of unreliability—carelessness, imperfect instruments, errors in reading a scale, errors in recording the measurement, differences in technique, variations in the coöperation of the children, and the like. From a practical point of view, errors may be minimized by care in following directions and by repeating individual measurements when anything of importance is at stake. In scientific studies variable errors tend to cancel each other when central tendencies are being computed, but they tend to diminish coefficients of correlation. Cases that show extreme errors, however, if the errors are apparent from inspection, may be excluded when computations are made.

In assembling the data for this paper particular attention was given to reliability. Instruments were carefully selected and efforts were made to keep them in good order. Two measuring staffs were used, and each individual was instructed in the work to which he was assigned. At intervals the author watched the procedure and sometimes even measured alongside a given worker. To stimulate care and to secure data for coefficients of reliability, some of the groups were measured twice within a few minutes by the same individuals.

Number of cases. The measurements reported in the following pages are based upon about 3600 cases, distributed by sex, age, city, and skin color as in table 1. With negligible exceptions the numbers within the several ages are the same for all the tables. It will be observed that the sampling is best for ages 8 to 13, inclusive, and clearly inadequate for ages below 6 and above 15.

Skin color. The classification of pupils by our rough color scale (light, medium, and dark) seems satisfactory for our purpose. Of 107 cases judged twice by the same persons, 86 were put in the same classification each time, and none were changed more than one step. In the cases in which the author also recorded a judgment, the agree-

TABLE 1

Number of children

AGE	LAREDO				EL PASO				BOTH CITIES			
	L	M	D	Total	L	M	D	Total	L	M	D	Total
A. Boys												
5					3	5	3	11	3	5	3	11
6					23	35	48	106	23	35	48	106
7	3	4	7	14	27	51	57	135	30	55	64	149
8	4	19	14	37	44	70	66	180	48	89	80	217
9	2	16	21	39	38	76	65	179	40	92	86	218
10	5	23	24	52	43	92	86	221	48	115	110	273
11	9	28	21	58	33	71	75	179	42	99	96	237
12	11	16	26	53	21	69	62	152	32	85	88	205
13	10	16	21	47	31	57	59	147	41	73	80	194
14	16	25	23	64	12	32	37	81	28	57	60	145
15	4	18	11	33	5	15	21	41	9	33	32	74
16	1	6	7	14	1	5	5	11	2	11	12	25
17	2	1	2	5		1	3	4	2	2	5	9
Total boys.	67	172	177	416	281	579	587	1,447	348	751	764	1,863
Per cent boys.....	16.1	41.3	42.5	100	19.4	40.0	40.6	100	18.7	40.3	41.0	100
B. Girls												
5					5	5	1	11	5	5	1	11
6					31	39	38	108	31	39	38	108
7	8	4	5	17	32	49	45	126	40	53	50	143
8	10	18	13	41	30	59	54	143	40	77	67	184
9	19	19	15	53	39	72	76	187	58	91	91	240
10	18	24	21	63	44	64	70	178	62	88	91	241
11	20	19	17	56	35	44	71	150	55	63	88	206
12	17	32	20	69	33	48	73	154	50	80	93	223
13	26	24	19	69	21	41	46	108	47	65	65	177
14	16	18	21	55	24	33	24	81	40	51	45	136
15	8	22	21	51	11	13	23	47	19	35	44	98
16	8	7	5	20	4	6	9	19	12	13	14	39
17	1	4	2	7		2		2	1	6	2	9
Total girls.	151	191	159	501	309	475	530	1,314	460	666	689	1,815
Per cent girls.....	30.1	38.1	31.7	100	23.5	36.1	40.3	100	25.3	36.7	38.0	100
Total boys and girls..	218	363	336	917	590	1,054	1,117	2,761	808	1,417	1,453	3,678
Per cent boys and girls.....	23.8	39.7	36.6	100	21.3	38.2	40.5	100	22.0	38.5	39.5	100

ment in general was high. Moreover, the percentages found by the Laredo staff to be light, medium, and dark, respectively (23.8, 39.7, 36.6), are very near the corresponding percentages (21.3, 38.2, 40.5) found by the El Paso staff. The tendency, however, to assign girls a lighter skin color than boys probably reflects, in part at least, a difficulty of the method.

From table 1 it may be seen that light, medium, and dark colors were assigned to boys (using approximate percentages) in the ratio of 19–40–41, to girls in the ratio of 25–37–38, and to both together in the ratio of 22–39–40. Thus it appears that at least a fifth and possibly a fourth of the group have light skin colors according to our three-division scale, and that about two-fifths have the dark skin color probably associated with the greatest percentage of Indian blood.

Height and weight. The measures most commonly used by the layman and at least until recently by the teacher in estimating physical status are height and weight. Tables of height and weight according to age have received wide currency, and, despite the doubt placed upon their value in estimating physical condition by the work of Franzen (2), are still widely used. It will be serviceable, therefore, to report height and weight together and to use in part tables corresponding more or less to those in common use.

It will be recalled that our children were weighed with clothing except hats, coats, shoes, and heavy sweaters and that the measures were made in the spring. To determine the allowance which should be made for clothing, some of the children were weighed with and without clothing or the clothing they wore was removed and weighed. The weight of the girls' clothing varied from ¼ to 1¼ pounds and averaged just a little more than ½ pound. The boys' clothing was a little heavier, ranging from ½ to 3 pounds. The average in one group was between 1¼ and 1½ pounds. In general, of course, the older and heavier children had the greater weight of clothing.

TABLE 2

Mean height and weight of Mexican children. Obtained values

Height is in inches, weight in pounds.

Allow about ½ pound for clothing for younger girls, ¾ pound for older girls, 1 pound for younger boys, and 1¼ pounds for older boys.

AGE GROUPS	HEIGHT		WEIGHT	
	Boys	Girls	Boys	Girls
6.0– 6.9	44.9	44.6	45.3	43.0
7.0– 7.9	46.7	46.6	48.9	47.7
8.0– 8.9	48.6	48.5	53.9	51.7
9.0 –9.9	50.8	50.6	60.0	58.0
10.0–10.9	52.6	52.6	64.9	63.4
11.0–11.9	54.5	55.0	71.7	71.9
12.0–12.9	56.5	57.4	79.2	83.7
13.0–13.9	59.4	59.4	90.4	89.2
14.0–14.9	61.4	60.1	100.3	98.6
15.0–15.9	62.9	60.5	108.2	101.3

The mean height and weight of our children in age groups six to fifteen (last birthday) are shown in table 2.

By a process of interpolation and extrapolation the heights and weights of our children at their *nearest* birthdays were estimated and are shown in table 3. This table shows also similar averages for "American-born" children, from the Baldwin-Wood tables printing of September, 1931 (1) and for children in Mexico, from the Publicaciones de la Secretaría de Educación Pública of Mexico (5). The Baldwin-Wood tables employ the median for height and the mean for weight. The Mexican tables report the "media" in centimeters and kilograms, but we have reduced these units to inches and pounds for our table. Curves based upon table 3 are presented in figures 1 and 2.

TABLE 3

Mean Height and Weight of Mexican children compared with Baldwin-Wood averages

AGE, NEAREST BIRTHDAY	HEIGHT			WEIGHT		
	Mexican		Baldwin-Wood‡	Mexican		Baldwin-Wood‡
	U. S.*	Mexico†		U. S.*	Mexico†	
			A. Boys			
6	43.8	43.7	46.0	43.4	41.9	48.3
7	45.8	45.5	48.0	47.1	46.3	53.1
8	47.7	47.8	50.1	51.4	50.7	58.2
9	49.7	49.8	52.2	56.9	56.2	63.9
10	51.7	51.8	53.9	62.4	61.7	70.1
11	53.6	53.5	55.7	68.3	68.3	76.5
12	55.5	55.3	57.5	75.4	73.9	82.9
13	57.9	57.9	59.6	84.8	83.8	91.7
14	60.4	60.6	62.2	95.4	94.8	104.9
15	62.2	63.2	64.7	104.2§	106.9	117.3
			B. Girls			
6	43.6	43.9	45.2	40.9	41.9	46.0
7	45.6	45.9	47.3	45.3	46.3	50.9
8	47.6	48.2	49.5	49.7	52.9	56.8
9	49.6	49.6	51.5	54.8	56.2	63.0
10	51.6	52.0	53.4	60.7	62.8	69.0
11	53.8	53.7	55.6	67.6	69.4	76.4
12	56.2	56.1	58.0	77.8	79.4	85.6
13	58.4	58.7	60.6	86.5§	98.1	99.6
14	59.8	59.5	62.2	93.9§	105.8	108.9
15	60.3	60.2	63.0	100.0§	110.2	115.5

* Our group. Heights and weights are derived from data in table 2 to give approximate values for ages at nearest birthday.

† Measures reported by Department of Psychopedagogy and Hygiene of the Secretariat of Education to Sixth Pan American Congress, June, 1930.

‡ Baldwin-Wood Tables for "American-born" boys and girls (clothed).

§ Average weight of boys at 15 and of girls at 13, 14, and 15 are of doubtful value (see text).

The heights of our children are remarkably close to those reported for children in Mexico. The weights also differ little except in the case of girls of ages 13, 14, and 15, for which

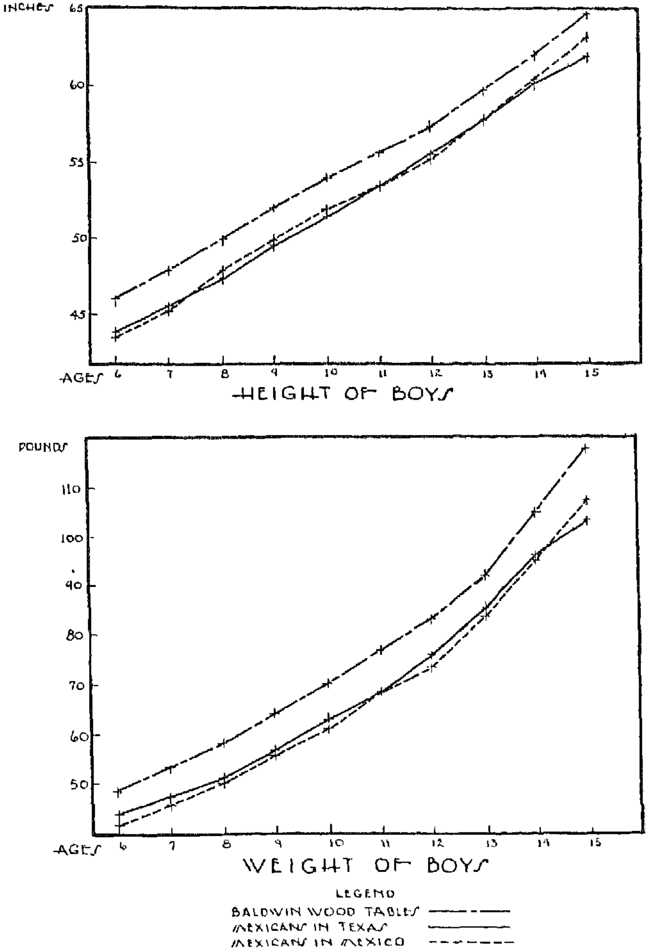
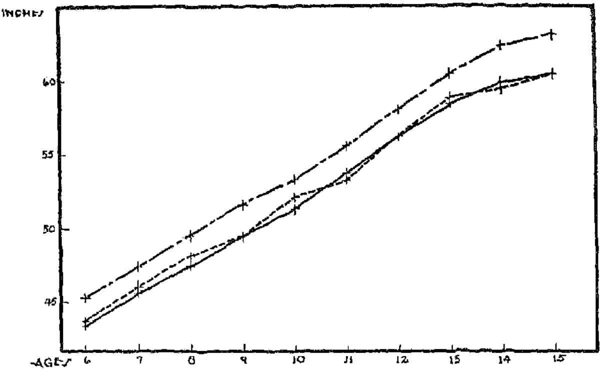
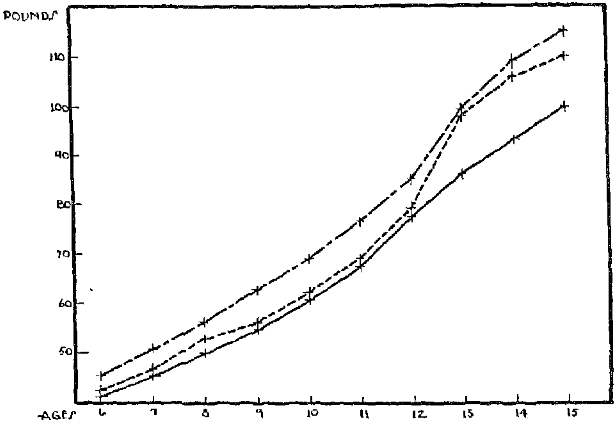


FIG. 1. Height and Weight of Boys, Ages Six to Fifteen, Nearest Birthday



HEIGHT OF GIRLS



WEIGHT OF GIRLS

LEGEND
BALDWIN WOOD TABLES —— - ——
MEXICANS IN TEXAS ————
MEXICANS IN MEXICO - - - - - - -

FIG. 2. HEIGHT AND WEIGHT OF GIRLS, AGES SIX TO FIFTEEN, NEAREST BIRTHDAY

ages apparently a selective factor tended to exclude the heavier girls from enrollment in the grades measured by us. The El Paso girls of ages nine to fifteen were on the average about 3.5 pounds heavier than the Laredo girls. In general our boys are slightly heavier than the boys in the group reported from Mexico and our girls a little lighter.

In comparison with the Baldwin-Wood averages our children are clearly a shorter and lighter group. The average difference in height of the groups of boys six to fourteen, inclusive, is 2.1 inches; for the groups of girls six to twelve inclusive, 1.8 inches. These differences are fairly uniform throughout the range of ages. Similar average differences in weight are 7.2 and 7.3 pounds, respectively, ranging from about five to nine pounds as age increases. When differences in the allowances for clothing are taken into account, the differences in weight will be reduced from $\frac{3}{4}$ to 2 pounds for boys and about $\frac{3}{4}$ of a pound for girls. Probably it is safe to say that our Mexican children are about two inches shorter, age for age, and about four to seven pounds lighter than the children reported in the Baldwin-Wood tables.

Weight—height—age tables similar to the Baldwin-Wood tables are presented as table 4. Naturally these tables represent a great deal of approximation. The table for girls is probably not fairly representative of the total population above age 12 because of the selective factor already mentioned. The table for boys at age 15 is in doubt for similar reasons.

Other measures. The means of three additional measures of skeletal size (width of shoulders, width of hips, and depth of chest) and the mean girth of the upper arm are shown in table 5.

Variability. An illustration of the variability of the measures is given in table 6, which shows the distribution of the measures of ten-year-old children.

Sex differences. Curves of growth, plotted from the means of tables 2 and 5, are shown in figure 3.

In general, the boys have slightly larger measures than the girls between the ages of six and ten or eleven except in the case of the width of hips, in which the girls take the lead at age seven. The earlier maturity of girls is shown in the crossing of the curves for all measures except width of hips at eleven or twelve. The curves recross at thirteen or fourteen. Again it is suggested that probably a number of the heavier girls have been omitted from our group.

A comparison with the Baldwin-Wood tables for height and weight suggests a possible earlier maturity for the Mexican children than for the children on whom the Baldwin-Wood tables were based.

Comparison by skin color. It was thought that a racial factor roughly correlated with skin color might appear in the measurements. Consequently, measures of light, medium, and dark children were tabulated separately. On account of the limitations of space only a summary based on ages seven to fourteen, inclusive, is given here. Differences were found between the mean measures of the light and dark, light and medium, and medium and

TABLE 4

*Weight—Height—Age Table—Mexican Children in Elementary Schools of Texas**

HEIGHT IN INCHES	AGES (NEAREST BIRTHDAY)										HEIGHT
	6	7	8	9	10	11	12	13†	14	15†‡	
					A. Boys						
42	39										42
43	41	41									43
44	43	43	44								44
45	45	45	46								45
46	47	47	48	48							46
47	49	49	50	50	51						47
48	51	51	52	52	53						48
49	53	53	54	54	55	56					49
50		56	57	57	57	58					50
51		59	60	60	60	60	61				51
52			63	63	63	63	63				52
53			65	66	66	66	66	66			53
54				68	69	69	69	69			54
55				71	72	72	73	73	73		55
56					76	76	77	77	77		56
57					80	80	81	81	81	81	57
58						84	85	85	85	85	58
59						88	89	89	89	89	59
60							93	93	93	93	60
61							98	98	98	98	61
62								102	102	102	62
63								106	106	106	63
64									110	110	64
65									115	115	65
66										121	66
					B. Girls						
41	36										41
42	38	38									42
43	40	40									43
44	42	42	42								44
45	44	44	44	44							45
46	46	46	46	46							46
47	48	48	48	48	48						47
48	50	50	50	50	50						48

* Age, nearest birthday; height, nearest inch; weight, nearest pound. Measured with clothing except shoes, coats, hats, and sweaters. Allow about ½ pound for clothing for younger girls, ¾ pound for older girls, 1 pound for younger boys, and 1¼ pounds for older boys.

† Weights for girls of ages 13, 14, and 15 are probably too low for the Mexican population in general.

‡ Weights for boys of age 15 may be too low for the Mexican population in general.

TABLE 4—*Concluded*

HEIGHT IN INCHES	AGES (NEAREST BIRTHDAY) 6	7	8	9	10	11	12	13†	14	15†‡	HEIGHT
					B. Girls—*Concluded*						
49		52	52	53	53	53					49
50		55	55	56	56	56					50
51			58	59	59	59	59				51
52				61	61	61	61				52
53				63	64	64	64	65			53
54				67	68	68	68	69	70		54
55					71	71	72	72	74	75	55
56					74	74	76	76	78	80	56
57						79	80	81	83	85	57
58						84	84	86	87	90	58
59							88	89	91	95	59
60							92	93	95	99	60
61								96	98	103	61
62								100	103	107	62
63									107	111	63
64									111	115	64
65										120	65

TABLE 5

Additional Measurements of Mexican children

(Means in centimeters)*

AGE (LAST BIRTHDAY)	WIDTH OF SHOULDERS		WIDTH OF HIPS		CHEST DEPTH		ARM GIRTH	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
6	25.4	24.8	20.1	20.0	9.1	9.0	16.7	16.4
7	26.6	26.2	20.8	21.1	9.5	9.5	16.9	17.0
8	27.4	27.1	21.6	21.8	9.8	9.7	17.5	17.4
9	28.6	28.1	22.7	22.8	10.2	10.0	18.3	18.2
10	29.7	29.3	23.6	23.8	10.5	10.3	19.0	18.8
11	30.6	30.5	24.6	25.2	10.8	10.7	19.7	19.7
12	31.5	31.9	25.7	27.2	11.1	11.3	20.5	20.9
13†	32.9	32.9	27.1	28.5	11.6	11.6	21.9	21.3
14†	34.5	33.9	28.5	29.8	12.1	12.0	23.0	22.5
15†	35.9	34.2	29.5	30.3	12.5	12.1	24.2	23.0

* To reduce to inches multiply by .39.

† Probably selection has made the means for girls of ages 13, 14, and 15 unreliable for the population as a whole—possibly also the means for boys of 15.

dark, respectively, at each of these eight year levels. Obviously, this makes 8 differences for each comparison of light and dark, light and medium, and medium and dark. The number of times the mean of the light was greater than that of the dark, the mean of the light greater than that of the medium, and the mean of the medium greater than that of the dark

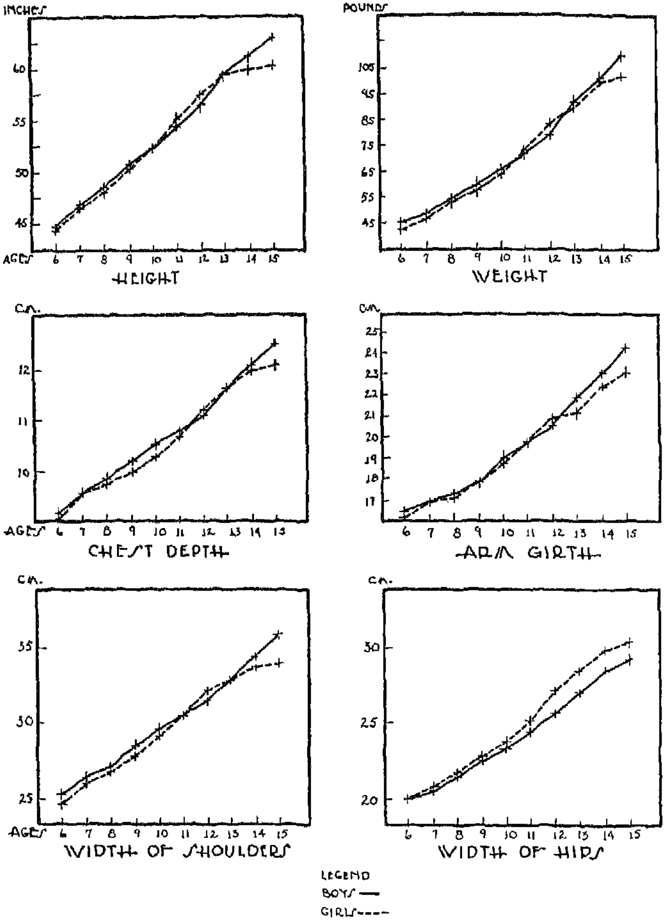


FIG. 3. CURVES OF GROWTH, AGES SIX TO FIFTEEN, LAST BIRTHDAY

TABLE 6

Distribution of Measures of Ten-Year-Old Children

HEIGHT			WEIGHT			WIDTH OF SHOULDERS			WIDTH OF HIPS			DEPTH OF CHEST			ARM GIRTH		
In.*	Boys	Girls	Lbs.	Boys	Girls	Cm.	Boys	Girls	Cm.	Boys	Girls	Cm.	Boys	Girls	Cm.	Boys	Girls
59	1	1	106–109	1		35	1	1	29	1		13	1		26	1	
58	2	1	98–101	2		34	2		28	1	3	12.5			25		
57	7	6	90–93		3	33	2	3	27	1	7	12	2		24		1
56	7	13	82–85	5	7	32	20	10	26	2	17	11.5	13	6	23	5	5
55	23	17	78–81	13	10	31	29	20	25	26	21	11	35	32	22	2	5
54	28	28	74–77	18	12	30	56	45	24	61	49	10.5	75	58	21	19	15
53	49	31	70–73	28	20	29	72	57	23	94	61	10	91	68	20	19	25
52	48	38	66–69	42	29	28	29	57	22	53	57	9.5	37	48	19	77	46
51	35	46	62–65	45	44	27	26	32	21	33	20	9	17	25	18	82	63
50	36	28	58–61	62	43	26	13	9	20	1	4	8.5	2	4	17	53	49
49	20	18	54–57	36	32	25	1	5	19		1	8		1	16	14	28
48	9	6	50–53	15	24	24	1	1							15		3
47	4	2	46–49	5	15										14	1	
46	2	2	42–45	1													
45		1															
44	1	1															
Total.......	272	239		273	239		272	240		273	240		273	242		273	240
Mean.......	52.6	52.6		64.8	63.4		29.7	29.3		23.5	23.8		10.5	10.3		19.0	18.8
S.D.........	2.4	2.4		8.9	9.4		1.7	1.7		1.3	1.6		.7	.7		1.5	1.7
S.D. of mean.....	.14	.16		.54	.61		.10	.11		.08	.10		.04	.04		.09	.11

* In., inches; lbs., pounds; cm., centimeters; S.D., standard deviation.

is shown in table 7. The table shows also the average differences between the means.

Reference to table 7 reveals small differences between the measurements of children of different color. The average difference (average of differences of means at different age levels) is in every case less than an inch, less than a pound, or less than a centimeter. Practically, therefore, the difference is negligible.

TABLE 7

Differences in measurements according to skin color

	HEIGHT	WEIGHT	WIDTH OF SHOULDERS	WIDTH OF HIPS	DEPTH OF CHEST	ARM GIRTH
1. Number of times in eight comparisons differences indicated are positive						
Light minus dark:						
Boys	7	5	5	5	2	6
Girls	8	5	5	3	2	4
Light minus medium:						
Boys	4	5	3	4	3	5
Girls	6	4	3	4	1	3
Medium minus dark:						
Boys	6	4	6	4	3	6
Girls	6	5	3	4	4	5
2. Average difference between means for the years 7–14						
Light minus dark:						
Boys	.59	.80	.25	.12	−.03	.24
Girls	.43	.28	−.03	.07	−.05	−.04
Light minus medium:						
Boys	.10	.71	−.01	.02	−.02	.16
Girls	.24	−.56	−.06	.03	−.09	−.13
Medium minus dark:						
Boys	.49	.10	.26	.10	.00	.08
Girls	.19	.84	.04	.04	.04	.09

From a theoretical standpoint it may be important to note a trend, not always consistent, for the lighter boys to have slightly higher measurements than the medium, and the medium to have slightly higher measurements than the dark. In the case of the girls, the children of medium color have higher means than those of dark color in all of the measures, but the position of those of light color with reference to both those of medium and those of dark color is variable, being sometimes above and sometimes below. On the whole, it appears that both boys and girls of dark color tend to be a little smaller than those of lighter color, except possibly in depth of chest. With these small differences our estimate of reliability may be based upon trends rather than upon the usual statistical test of the adequacy of sampling. A suggestion of the difference in means required for statistical reliability may be had from a study of table 6, which shows a distribution of the measures of ten-year-old children. The following computation also is suggestive. At age ten there were 48 light and 109 dark boys. Their mean heights are 52.52 and 52.10, respectively; the standard deviations, 2.73 and 2.37; the standard deviations of the means, .39 and .23; the difference of the means, .42; the standard deviation of the difference of the means, .45. Whether this apparent difference in size is an aspect of race, or of economic status, or of some other factor is not clear.

SUMMARY

This paper has presented a brief report of measures of height, weight, width of shoulders, width of hips, depth of chest, and arm girth of Mexican school children in the elementary grades of Laredo and El Paso, Texas.

Of 1863 boys, ages five to seventeen, 18.7 per cent were classified as of light, 40.3 per cent of medium, and 41 per cent of dark skin color. Of 1815 girls of the same ages, 25.3 were classified as of light, 36.7 of medium, and 38 per cent of dark skin color. Both boys and girls of darkest classification showed a tendency to be a little smaller than those of lighter color, except perhaps in depth of chest. The average difference of means at age levels seven to fourteen, however, was less than an inch, a pound, or a centimeter. It is not clear whether this tendency on the part of darker children reflects race, economic condition, or some other factor.

Means of age groups six to fifteen for the various measures are given in the text with a table showing the distribution and variability at age ten. In addition height—age—weight tables similar to those already available for "American" children are presented.

The heights and weights of our Mexican children correspond closely to those reported from Mexico except in the case of girls of ages thirteen, fourteen, and fifteen, in which age groups a selective factor seems to have eliminated some of the larger girls from the school grades measured in this study. In general our boys are slightly heavier than the boys in the group reported from Mexico and our girls a little lighter.

Compared with the "American" children of the Baldwin-Wood tables, our Mexican children of ages six to fourteen (boys) and six to twelve (girls) are about two inches shorter, age for age, and about four to seven pounds lighter.

Except in width of hips the measures of the boys are generally greater than those of the girls up to age ten or eleven. The curves cross at eleven or twelve and recross at thirteen or fourteen. There is some suggestion from the measures that Mexican boys and girls mature somewhat earlier than the children of the Baldwin-Wood tables.

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A Scale for Measuring Attitude Toward the Question of Children's Freedom

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THIS paper will describe (1) an attitude scale concerned with the question of the degree of freedom, independence, and self management children should be allowed, and (2), group differences in response to the scale. Sex, age, occupation, formal education, marriage or lack thereof, contact with children and reputed degree of severity or leniency in discipline are the variables whose relationship to the attitude scale results we shall attempt to reveal by means of the group comparisons.

Though we have had no hopes of constructing an instrument satisfactory for the diagnosis of the details of an individual's attitude, one of value in uncovering certain group differences did seem possible. Such a scale should be of service in the tasks of evaluating the relative effectiveness of adult or parent education programs, or of describing the lay of the land in various racial or socio-economic groups.

Method. Our scale was derived according to the method outlined by Dr. Thurstone (2). Since the work was begun several years ago and improvements over Dr. Thurstone's earlier techniques have been announced by him and others from time to time in recent years, our procedure may seem unduly cumbersome. Though cumbersome, we are inclined to believe the procedures employed are essentially dependable if the fundamental assumptions underlying attitude measurement according to the Thurstone method are granted. More extended comment on this point will be made later.

Procedure. Each of the four authors prepared a series of statements. These were then submitted to the whole group for criticism and evaluation. Those statements which, in the opinion of the group, were not possessed of the characteristics listed by Thurstone (2) and Wang (3) as desirable or which virtually duplicated others in the series were rejected. The statements believed to be worth experimenting with numbered 123.

Judges. These 123 statements, each printed on a separate card, were submitted to 200 judges for sorting into eleven piles on the basis of the degree the view expressed was lenient or stern. Thurstone now prefers a small group of highly trained judges, and with this view we are in sympathy. We believe, however, our use of many judges caused us unnecessary labor but did not very seriously mar the results. The data in table 1 describe the group as to education, sex, and wedded state. The group, it is apparent, is well educated, 92 per cent being college trained and 39 per cent possessed of some experience with graduate work. Since we had reason to be mistrustful of the ability of the majority of the uneducated to make the discriminations which the sorting entailed, we limited our judges almost entirely to the college group. We should have liked a group more heterogeneous culturally because we suspected that values assigned our statements might vary somewhat with this factor. Hinckley (1), however, has not found the placement of statements to depend significantly on the judges, in the case of the issue (the social position of the negro) and the groups he dealt with.

All of the judges received carefully prepared written instructions, and most of them received, in addition, individual guidance. Where it was clear the task of sorting had been misunderstood, the results were discarded. That the scaling is dependable is suggested by the fact that when the values for the statements obtained on the basis of the sorting of two groups of 100 judges are correlated the coefficient is +.97.

TABLE 1

Classification of the judges who sorted the statements

EDUCATION	MALE		FEMALE		TOTAL (NUMBER)
	Married (number)	Single (number)	Married (number)	Single (number)	
Grade school	3	0	0	0	3
High school	6	2	4	0	12
College	10	18	39	39	106
Graduate study	28	3	18	30	79
Total	47	23	61	69	200

THE SCALES

Following, you will find thirty-three statements expressing different attitudes toward the question of children's rights and liberties.

Put a check mark (✓) if you *agree* with the statement.

Put a cross (×) if you *disagree* with the statement.

If you cannot decide about a statement, you may mark it with a question mark. This is not an examination. People differ in their opinions about what is right and wrong in this issue.

Scale I

1. A young child must be disciplined until he has learned not to touch those objects in his environment which he cannot handle without damaging.
2. When a child's wants and those of an adult are in conflict, the child should receive the more consideration.
3. Parents should feel called upon to give reasons to the young child for the restrictions imposed, only when he is capable of understanding.
4. A pre-school child should never be allowed to have his own way.
5. A child who is entangled in a disciplinary problem should be allowed to explain his point of view.
6. A child should be restricted only when he is infringing upon the rights of others.
7. Adults should give no suggestions which will influence the form of a child's play constructs.

8. Play activities should never be supervised.
9. Implicit obedience is always desirable.
10. Leniency in restricting the liberties of a child is better than too much severity.
11. A child's whims and impulsive desires should never be humored.
12. Children should be given reasons for the restrictions placed upon them.
13. It is necessary to teach a child that he cannot always have his own way.
14. A pre-school child should, from the time he shows any inclination to do so, be allowed to choose the dress or suit he is to wear.
15. Children are being allowed too much freedom.
16. The wishes of the child should usually be respected.
17. I would have the child ask permission before engaging in activities that are new or strange.
18. A pre-school child should be allowed freedom of action except in matters pertaining to his health and physical safety.
19. A child should be forced to obey if he does not do immediately as he is told.
20. I would place no restriction on the child's activity except in times of grave danger to himself or others.
21. A child should be given anything he wants to eat.
22. The child should be allowed free choice in the matter of associates.
23. Matters of conduct should be decided by the parent and child together.
24. A child should be required to say "please" whenever he makes a request.
25. When a child's wants and those of an adult are in conflict, the adult should be given the more consideration.
26. Restrictions should not be imposed when they will discourage the child's spontaneous efforts.
27. A child should be taught to obey an adult unquestioningly.
28. The parent should choose the group with which the child is to associate, but the child should be allowed free choice with respect to his companions within the group.
29. A child should obey his parents because they are his parents.
30. The parent should comply with every demand of the child.
31. A child should be required to obey immediately in matters pertaining to health and physical routine.
32. Children's activities, when they seem to an adult to be destructive or wasteful, should be restricted.
33. A child's playthings are not his to do with as he pleases.

Scale II

1. Except in danger situations, a child should never be expected to obey without being given an adequate reason.
2. The child should be taught to respect the wishes of his elders.
3. When imposing restrictions upon a child, a parent should have well considered reasons and should be willing to give them.
4. A child should be required to eat everything that is set before him.
5. A child should never be forced to do a thing he does not wish to do.
6. Rigid training for obedience should be started in infancy.
7. I believe in placing upon young children but few restrictions and enforcing these strictly.
8. In all quarrels between young children adults should arbitrate.
9. A child should never be required to say "please."
10. The will of the parent should be dominant over the will of the child.
11. In his explorations of property the child should always be under close supervision.
12. A child should be given more than one chance to obey.
13. It is the parents' task to make the child want to do what is good for him.
14. A child's liberty should be restricted in danger situations only.
15. When a child is absorbed in his own immediate affairs, a parent should consider the fact before making a demand.

16. Natural forces, not individuals, should discipline the young child.
17. Little children should be forced to obey, but the control of older children should be less exacting.
18. Within the limits of justice and safety, a young child in his play should be free from adult interference.
19. The older pre-school child should be allowed a certain amount of freedom in making decisions and assuming the consequences.
20. A child should be allowed to do as he wishes in all things.
21. A child should be given a choice in every matter possible.
22. A child should always be supervised by his parents in his work activities.
23. From a selection of foods chosen by an adult as suitable for the young child, the child should be allowed to choose freely.
24. The "Puritan" method of bringing up children is the best method.
25. If a child does not comply at once with a request in matters pertaining to health, he should be forced to.
26. The child's own limitations in relation to his physical environment should be all that should restrict him in his play activities.
27. The whims of the child should be repressed at all times.
28. Within certain selected situations, a child should be allowed to assert his personal likes and dislikes.
29. A child should be permitted to do as he wishes with his own playthings.
30. A child should never be allowed openly to disagree with his parents.
31. In the face of an emergency situation the immediate obedience of the child should be required.
32. A child should be encouraged but not required to say "please" when he makes a request.
33. A child should not be allowed to destroy or abuse his own playthings.

Selection of statements. From the 123 scaled statements 66 were chosen—i.e., two series of 33 each. The bases of selection were primarily those of scatter, relatively low Q value, brevity, and similarity of rating at the hands of the two groups of 100 judges. Since it was our intention that the statements should scatter rather evenly over the scale, in most cases a group of three whose values spread well over the interval were chosen from each of the 11 units. This was done for each of the two scales.

The scale and Q values for each statement are given in table 2. The Q's are, doubtless, larger than they would have been, had we employed a few highly trained judges. They are of about the order of magnitude of those published by Thurstone and Chave (2) for their scale on attitude toward religion.

Reliability of the scales. These somewhat large Q's may not be attributable entirely, however, to untrained judges but may reflect a quality of vagueness in the statements. This may be responsible also, in part at least, for the none too high correlation we obtained between the scores on our two scales. This coefficient, based on the opinions of 233 adults representing a rather heterogeneous population, was +.681. It is possible that, although the statements were scaled along a given diagonal, when this diagonal is not emphasized to the degree it is in the task of sorting, other dimensions become more apparent. We were, for example, suspicious for a time of the high frequency with which certain statements of intermediate value tended to be checked. This one would expect to have a leveling effect. To test our hypothesis, we re-scored all papers omitting in Scale I, Statements 5, 12, 13, 16, and 32; and in Scale II, Statements 2, 13, 15, 18, and 31. Regularity in the spacing of items was thus sacrificed, but both instruments were altered in the same areas. The scores on the two abridged scales correlated lower with each other, to our surprise, than did those for the original instruments.

TABLE 2

Scale values, Q, and popularity values of the statements in Scales I and II

STATEMENT NUMBER	SCALE I		SCALE II		SCALE I				SCALE II			
	Scale value	Q	Scale value	Q	Statement number	Scale value	Q	Relative frequency of checking	Statement number	Scale value	Q	Relative frequency of checking
1	7.09	2.42	2.59	2.89	30	.55	.55	.004	20	.54	.55	.00
2	2.56	2.47	7.72	2.59	21	.63	.63	.004	5	.67	.67	.04
3	6.00	2.00	5.25	1.69	8	.74	1.07	.02	9	.91	1.66	.05
4	10.43	.57	10.01	1.90	22	1.14	1.52	.04	16	1.23	2.28	.14
5	4.87	2.29	.67	.67	7	1.62	2.04	.05	26	1.54	1.59	.13
6	3.10	2.84	9.44	2.00	20	1.98	1.68	.18	29	1.81	2.04	.20
7	1.62	2.04	5.75	2.12	14	2.48	2.49	.37	21	2.14	2.63	.60
8	.74	1.07	8.77	2.71	2	2.56	2.47	.29	14	2.32	2.23	.13
9	9.65	1.84	.91	1.66	18	2.72	2.30	.31	1	2.59	2.89	.17
10	4.39	1.64	9.81	1.98	6	3.10	2.84	.18	18	3.38	3.01	.80
11	9.76	1.84	8.16	2.03	16	3.36	2.52	.66	23	3.79	2.92	.60
12	4.24	2.38	3.95	2.80	26	3.93	2.65	.66	12	3.95	2.80	.62
13	5.95	1.74	5.62	1.81	12	4.24	2.38	.72	15	4.24	2.59	.88
14	2.48	2.49	2.32	2.23	10	4.39	1.64	.72	19	4.41	2.38	.80
15	7.83	2.52	4.24	2.59	5	4.87	2.29	.92	32	4.63	2.24	.72
16	3.36	2.52	1.23	2.28	23	5.27	1.37	.58	28	5.01	1.98	.81
17	6.64	2.17	7.61	2.45	28	5.44	1.29	.79	3	5.25	1.60	.89
18	2.72	2.30	3.38	3.01	13	5.95	1.74	.92	13	5.62	1.81	.86
19	10.03	1.50	4.41	2.38	3	6.00	2.00	.58	7	5.75	2.12	.58
20	1.98	1.68	.54	.55	17	6.64	2.17	.51	31	6.24	2.58	.84
21	.63	.63	2.14	2.63	32	6.75	2.15	.69	33	7.17	2.60	.68
22	1.14	1.52	8.41	2.36	1	7.09	2.42	.65	17	7.61	2.45	.13
23	5.27	1.37	3.79	2.92	31	7.32	2.49	.56	2	7.72	2.59	.74
24	8.04	2.32	10.29	.96	15	7.83	2.52	.24	25	7.81	2.53	.42
25	8.22	2.02	7.81	2.53	24	8.04	2.32	.26	11	8.16	2.03	.26
26	3.93	2.65	1.54	1.59	25	8.22	2.00	.17	22	8.41	2.36	.15
27	10.30	.85	10.28	.97	33	8.51	2.34	.24	8	8.77	2.71	.08
28	5.44	1.29	5.01	1.98	9	9.65	1.84	.31	30	9.36	1.96	.11
29	9.85	1.43	1.81	2.04	11	9.76	1.84	.08	6	9.44	2.00	.41
30	.55	.53	9.36	1.96	29	9.85	1.43	.14	10	9.81	1.98	.21
31	7.32	2.49	6.24	2.58	19	10.03	1.50	.12	4	10.01	1.90	.17
32	6.75	2.15	4.63	2.24	27	10.30	.85	.10	27	10.28	.97	.05
33	8.51	2.34	7.17	2.60	4	10.43	.57	.04	24	10.29	.96	.02

Another hypothesis that presented itself to us—i.e., that the inter-scale r might have been depressed by differences in the popularity values of statements in corresponding areas of the scale—was likewise found to have little in the way of evidence to support it. If for the items whose values fall in the various intervals of the scale, we average the measures of relative frequency of endorsement and then compare these averages for the two scales, we do not find striking differences, except in one case, which is due in part to our grouping procedure. (See table 3.) When the grouping according to interval is abandoned and the popularity values of each successive three statements are averaged, the data for the two scales are rather similar. The averages for the fourth group of three show the greatest disparity.

TABLE 3

Average popularity value of statements in corresponding areas of Scales I and II

AREA OF SCALE	SCALE I	SCALE II
0- .99	.01	.03
1.00- 1.99	.09	.16
2.00- 2.99	.32	.30
3.00- 3.99	.50	.67
4.00- 4.99	.79	.80
5.00- 5.99	.76	.79
6.00- 6.99	.59	.84
7.00- 7.99	.48	.49
8.00- 8.99	.22	.16
9.00- 9.99	.18	.24
10.00-10.99	.09	.08

Limitations of the usefulness of the scales. Finally, it occurred to us that we might have made false assumptions regarding the boundaries of usefulness of our scales. Even if we assume our respondents entirely frank, we are doubtful, for instance, of the suitability of the scales for use with the less educated groups. Perhaps with these groups we are guilty of an absurdity virtually parallel to asking subjects to check a scale written in a foreign language. Are the less educated, or perhaps duller individuals sufficiently discriminating with respect to linguistic subtleties to appreciate even the grosser differences expressed by the statements? We noted, for example, that those of our subjects with the least schooling checked many more of the items than did the more educated. (See table 4.) The statements, moreover, which the former affirmed expressed their opinions were scattered more widely over the scale. For each individual we derived a consistency index—i.e., the average deviation of the values of the statements endorsed by him. These average deviations are clearly greater for the less educated groups than for the more educated. (See table 4.)

If the statements were sufficiently comprehended, we should be obliged to conclude that the attitude people have with respect to the issue of concern to us does not express itself in congruent endorsements, for even our educated subjects could scarcely be described as highly consistent. It seems not unlikely, of course, that instead of being guided by a broad philosophy or carefully considered generalizations, people think largely in terms of small segments of behavior and more or less specific situations. This characteristic may be emphasized in the case of the question at hand because most individuals have had a certain amount of direct and intimate contact with children. These specific personal experiences, with their tangles of values, may tend to militate against untempered bias, which simulates generalization because of the lack of analysis, and, on the other hand, do little to stimulate effective generalization, which would involve the square facing of certain philosophical issues and a synthesizing of the units of analysis.

Effect of number of statements presented. Though the comment may seem somewhat irrelevant at this point, we cannot refrain from calling attention to a tendency we noted incidentally in our data and for whose effect we had to adjust in subsequent analyses. Most of our subjects were presented with a blank containing the 123 statements and then were scored merely on the basis of the items designated for inclusion in Scales I and II. A limited number of individuals (about 125), however, were given a test blank containing only the 33 statements of Scale I. When the returns from parallel sex, education, and marriage groups were compared, we noted that the subjects given the opportunity of selecting from 123 statements endorsed fewer than those whose selection was limited to 33 statements. Our belief—though the tendency is not so unequivocal—is that the former were also more consistent. The cases, in any one group are too few to justify extended presentation of our data; but the trend, at least in the case of the index, number of items approved, is very consistent. This observation needs confirmation; and if corroborated, would suggest a modification in the procedure of administering attitude scales. Perhaps, even though the statements believed on the basis of other criteria to be the more diagnostic are the only ones used in computing the attitude score, the presentation of the subject with a large array of statements may have a salutary effect through refining his discriminations. More work needs to be done to clarify the questions both of the number of

TABLE 4

Mean number of items checked by an individual and mean of the average deviations of the score values of an individual's checkings—Sex, education, and marriage groups—Scale I

EDUCATION	FEMALE										MALE									
	Married					Single					Married					Single				
	Number of cases	Mean number of items checked	σ_m	Mean average deviation of checkings	σ_m	Number of cases	Mean number of items checked	σ_m	Mean average deviation of checkings	σ_m	Number of cases	Mean number of items checked	σ_m	Mean average deviation of checkings	σ_m	Number of cases	Mean number of items checked	σ_m	Mean average deviation of checkings	σ_m
Grades	21	18.31	.90	1.88	.08	1	18.00		1.60		12	21.02		1.00		3	13.17		1.83	
High school	41	17.33	.68	1.75	.06	19	19.71	.85	1.96	.07	25	20.06	.66	1.94	.04	10	18.90		1.82	
College	57	13.04	.56	1.30	.04	31	12.82	.61	1.33	.05	12	13.33		1.50		25	14.50	.52	1.52	.07
Graduate study	29	10.74	.51	1.22	.04	33	10.77	.85	1.29	.07	38	10.64	.72	1.33	.07	4	14.75		1.64	

TABLE 5

Distribution of scores—Scale I

SCALE	FREQUENCY			DIAGRAM
	Female	Male	Total	
3.50	1	1	2	xx
3.75	4	1	5	xxxxx
4.00	8		8	xxxxx xxx
4.25	11	4	15	xxxxx xxxxx xxxxx
4.50	10	5	15	xxxxx xxxxx xxxxx
4.75	20	11	31	xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx x
5.00	29	14	43	xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxx
5.25	30	11	41	xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx x
5.50	24	13	37	xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xx
5.75	33	20	53	xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxx
6.00	23	10	33	xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxx
6.25	10	15	25	xxxxx xxxxx xxxxx xxxxx xxxxx
6.50	14	11	25	xxxxx xxxxx xxxxx xxxxx xxxxx
6.75	8	5	13	xxxxx xxxxx xxx
7.00	3	2	5	xxxxx
7.25	1	1	2	xx
7.50	2		2	xx
7.75		1	1	x
8.00	1	1	2	xx
8.25				
8.50		1	1	x
Total number..	232	127	359	
Mean score....	5.54	5.78	5.62	
σ_{dist}..........	.77	.84	.82	
σ_m............	.05	.08	.04	

items that ought to be presented and the effect upon findings of the number of items scored.

Distribution of scores. To test the suitability of our instruments for revealing certain group differences, Scale I was given to 359 adults in widely scattered parts of the country, Chicago, however, furnishing a lion's share of the returns. The composition of the group with respect to sex, age, single or married state, education, and occupation is described in the case counts of table 11. The scores obtained ranged from 3.50 to 8.50, the *possible range being from .55 to 10.43.* The mean score was 5.62. The distribution seemed characterized by a bimodality. (See table 5.) Whether this is attributable to chance, or is an artifact due to the scale, or to the selection of subjects, is not entirely clear; but we suspect the latter. A heavy weighting of student and professional groups—those with liberal tendencies—may be responsible for the apparent division. This hypothesis is supported by the fact the second mode is in the liberal direction. Because of the difficulty the uneducated had in interpreting the statements, we did not reach as many of this group as we desired.

TABLE 6

Distribution of scores—Scale II

SCALE	FREQUENCY			DIAGRAM
	Female	Male	Total	
3.25	2		2	xx
3.50				
3.75	1	1	2	xx
4.00	6	2	8	xxxxx xxx
4.25	7	5	12	xxxxx xxxxx xx
4.50	15	9	24	xxxxx xxxxx xxxxx xxxxx xxxx
4.75	21	9	30	xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx
5.00	35	9	44	xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxx
5.25	19	7	26	xxxxx xxxxx xxxxx xxxxx xxxxx x
5.50	19	7	26	xxxxx xxxxx xxxxx xxxxx xxxxx x
5.75	19	3	22	xxxxx xxxxx xxxxx xxxxx xx
6.00	17	5	22	xxxxx xxxxx xxxxx xxxxx xx
6.25	8	1	9	xxxxx xxxx
6.50	6	2	8	xxxxx xxx
6.75	1	1	2	xx
7.00	2	1	3	xxx
7.25	1		1	x
Total number.	179	62	241	
Mean score....	5.37	5.24	5.33	
σ_{dist}......	.70	.71	.70	
σ_m	.05	.09	.05	

Scale II was given to only 233 individuals. This group overlapped that which responded to Scale I. The student and professional groups constituted proportionally more of the respondents to Scale II than to Scale I. The score range was correspondingly restricted, extended only from 3.25 to 7.25. The mean score was 5.38. (See table 6.) The mode is slightly off center in the liberal direction, a finding which the composition of the group would lead us to expect. No bimodality appears in the distribution.

TABLE 7

Mean attitude score for an individual—Sex and education groups—Scale I

EDUCATION	FEMALE			MALE		
	N	M	σ_m	N	M	σ_m
Grades	22	6.30		15	6.13	
High school	60	5.98	.09	35	6.09	.11
College	88	5.38	.07	37	5.60	.13
Graduate study	62	5.11	.09	40	5.54	.15

TABLE 8

Mean attitude score for an individual—Sex and education groups—Scale II

EDUCATION	FEMALE			MALE		
	N	M	σ_m	N	M	σ_m
Grades	11	6.21		2	6.37	
High school	36	5.76	.11	11	5.78	
College	76	5.25	.07	13	5.29	
Graduate study	56	5.13	.09	36	4.93	.10

Education. Among the group comparisons, those which show the most clear-cut differences are the ones concerned with education. (See tables 7–11.) In the case of both the men and the women, the greater the amount of academic education, the more liberal the opinion expressed. There is a steady regular increase through the four groups, grade school, high school, college, and graduate study. This finding seems reasonable and suggests that education makes for a more liberal view of the rights and capabilities of children, though it is, of course, possible that intelligence rather than education is the really significant determinant of the group differences observed. We have no data that could be brought forward to alter this deadlock of hypotheses.

Opinion and conduct. Perhaps education, if it plays a rôle in the responses to our scale, operates largely through calling attention to enlightened opinion, instead of in more significant and subtle ways. In other words, the more educated may know the preachings of the educational philosophers and child psychologists but actually pay little regard to these preachings in their own practices. Since our results give no direct clues in regard to practice, we do not know to what degree opinion and conduct are harmonious. We tried to get some light on the question by appealing to our friends for help in the location of individuals reputed to be conspicuously stern or lenient in their discipline of children. Seventy-one of the former and 40 of the latter responded to our scale. Table 13 provides a rough description of the results. It is clear that the critical ratios (table 14) are large enough to justify confidence in

TABLE 9

Mean attitude score for an individual—Sex, education, and marriage groups—Scale I

EDUCATION	FEMALE						MALE					
	Married			Single			Married			Single		
	N	M	σ_m	N	M	σ_m	N	M	σ_m	N	M	σ_m
High school	41	5.92	.12	19	6.09	.14	25	6.05	.14	10	6.13	
College	57	5.38	.09	31	5.19	.10	12	5.85		25	5.47	.16
Graduate study	29	4.75	.12	33	4.72	.11	36	5.50	.14	4	5.88	

TABLE 10

Mean attitude score for an individual—Sex, education, and marriage groups—Scale II

EDUCATION	FEMALE						MALE					
	Married			Single			Married			Single		
	N	M	σ_m	N	M	σ_m	N	M	σ_m	N	M	σ_m
Grades	11	6.21					1	6.13		1	6.63	
High school	33	5.71	.11	3	6.21		6	5.66		5	5.72	
College	51	5.26	.09	25	5.26	.10	12	5.35		1	4.63	
Graduate study	28	4.87	.11	28	5.40	.11	35	4.93	.10	1	4.63	

TABLE 11

Mean attitude score for an individual—Sex, education, age, and marriage groups—Scale I

MARRIED OR SINGLE	EDUCATION	FEMALE						MALE					
		29—		30-39		40+		29—		30-39		40+	
		N	M	N	M	N	M	N	M	N	M	N	M
Married	Grades	2	5.88	4	5.88	15	6.55	0		3	6.46	9	6.70
	High school	10	5.80	13	5.94	18	6.00	7	6.52	9	5.88	9	5.85
	College	14	5.50	30	5.38	13	5.62	2	6.25	3	5.05	7	6.13
	Graduate study	10	5.05	14	4.62	5	4.28	4	4.88	22	5.65	10	5.41
Single	Grades	1	5.00	0		0		2	6.13	0		1	5.62
	High school	14	6.08	2	5.63	3	6.37	6	6.21	1	5.88	3	6.21
	College	20	5.20	7	6.08	4	5.32	24	5.44	0		1	6.13
	Graduate study	16	5.50	9	5.43	8	5.29	3	6.71	1	3.62	0	

the group differences revealed. The lenient fall below the average based upon all of our subjects; the stern, above. In the case of Scale II, only 5 per cent of the lenient exceeded the mean of the stern; whereas in the case of Scale I, 15 per cent did. Since the standard of selection for the representatives of the extreme groups was not constant, the relationship described is doubtless more marked than our results indicate.

TABLE 12

Mean attitude score for an individual—Sex, education, age, and marriage groups—Scale II

MARRIED OR SINGLE	EDUCATION	FEMALE						MALE					
		29—		30–39		40+		29—		30–39		40+	
		N	M	N	M	N	M	N	M	N	M	N	M
Married	Grades			2	5.88	9	6.27	0				1	6.13
	High school	7	5.48	10	5.58	16	5.91	1	7.37	2	5.38	3	6.13
	College	12	5.36	28	5.13	11	5.36	1	5.13	4	5.44	7	5.76
	Graduate study	9	5.10	14	4.84	5	4.53	4	4.82	21	5.26	10	5.18
Single	Grades							1	6.63				
	High school	1	5.63			2	6.50	3	5.63	1	5.63	1	6.13
	College	15	5.34	6	5.13	4	5.13	1	4.63				
	Graduate study	11	5.54	9	5.57	8	5.00	0		1	4.63		

TABLE 13

Means, sigmas, and sigmas of the means of the attitude scores of those reputed to be lenient or stern in their discipline of children—Scales I and II

GROUPS	SCALE I				SCALE II			
	N	M	$\sigma_{dist.}$	σ_m	N	M	$\sigma_{dist.}$	σ_m
Lenient	40	5.02	84	.13	40	4.98	62	.10
Stern	71	5.84	78	.09	71	5.79	72	.09
All subjects	363	5.62	82	.04	241	5.33	70	.05

TABLE 14

Critical ratios—Discipline groups—Scales I and II

COMPARISON	SCALE I	SCALE II
Stern—lenient	5.04	6.25
Stern—all subjects	1.23	6.11
Lenient—all subjects	4.56	3.12

Sex differences. In virtually all of the comparisons between the sexes involving Scale I (see tables 7, 9, and 11), the men seem a little less lenient than the women. Not only is this difference shown when all data are pooled, but also when groups segregated on the basis of education, wedded state, age, or occupation are compared. This finding, too, while the differences are not great, is in accord with tradition. The fact that the results with Scale II should not show such a clear-cut trend is perhaps to be accounted for in terms of the limited number of males coöperating.

Occupation. Among the occupation groups the order from liberal to less liberal is student, executive—professional, small-business—clerical, and trades—unskilled—labor. (See table 15.) We had felt that economic security might make for more tolerance and better family relations, but our results seem more readily interpretable in terms of an education or even an intelligence factor rather than any essentially economic one, though we grant it is difficult to separate the three. That education is very likely active is suggested by the fact that the student group, which, taken as a whole, is probably not so secure but quite as intelligent as is the professional and business executive group, is the more liberal of the two.

TABLE 15

Mean attitude score for an individual in various occupational groups—Scale I

OCCUPATIONS	FEMALE		MALE	
	N	M	N	M
Professional and business executive	63	5.68	72	5.29
Small business and clerical	16	5.94	17	5.85
Trades and unskilled labor	20	6.33	3	5.88
Student	28	5.47	18	5.41
Homemaker			126	5.65

TABLE 16

Mean attitude score of individuals classified according to the nature of their adult contacts with children

NATURE OF CONTACT WITH CHILDREN	MALE		FEMALE	
	N	M	N	M
Parent	65	5.74	117	5.58
Sib	35	5.69	33	5.64
Teacher	15	5.43	70	5.38
Miscellaneous	23	5.35	47	5.32
No contact	20	5.95	25	5.79

Age and marriage. Analyzing our results to reveal the influence of age and of marriage, we uncovered nothing of significance. No legitimate combining of the groups shown in tables 7 to 12 revealed any consistency; and certainly these tables show none.

Contact with children. The effect of the nature or the extent of the adult's contacts with children, we attempted to expose by group comparisons; but, again, limited numbers prevented us from disentangling the variable satisfactorily from others. Our classes, moreover, were not discrete; and hence, if a subject placed himself in several categories, we listed him in each. The results, whatever they may mean, are consistent both for males and females, in revealing individuals having no contact with children to be the most stern and teachers rather lenient.

Parents and sibs seem to fall somewhere between these groups. The miscellaneous group, including pediatricians, clinicians, playground directors, neighbors, etc., score lowest of all. We are not sure to what extent formal education, rather than the nature of the specific contacts with children, is responsible for the findings shown in table 16. That the former is not the whole story is suggested by the fact that the group professing to have no contact with children is not an uneducated one.

SUMMARY

A description was given of two forms of a scale for measuring attitude toward the question of the freedom, independence, and self-management children should be allowed.

The two forms described correlated with each other to the extent of +.681.

The average deviation of the scale values of the statements endorsed by an individual as well as the number of items approved, tended to vary inversely as the amount of formal education of the respondents. It is possible, however, that intelligence rather than education was the major determinant of the finding.

Our female subjects tended to be more liberal than did the males, and the best educated than the less well educated.

Groups based upon occupational status or nature of adult contact with children showed some consistent differences in attitude score; but it was not possible to disentangle satisfactorily the variables underlying the group classifications from such factors as schooling or intelligence. Those professing to have no contact with children tended to be stern, whereas the professional-executive and especially the teaching groups tended to be rather lenient.

Neither age, within the limits we explored, nor single or married state, seemed to affect conspicuously attitude scores.

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Children's Preferences Among Play Materials as Determined by the Method of Paired Comparisons of Pictures

THOMAS F. VANCE AND LOUISE T. MCCALL

INVESTIGATORS who have concerned themselves with the problem of children's preferences for different play materials have, for the most part, used the method of observing the children in their spontaneous play. Some of the reports of such investigations cite certain limitations of this method. Bridges (2) (3) stated that the children were hindered or probably forced to use material they did not prefer because the material they actually preferred was being used by other children. Bott (1) claimed that "imitation and leadership were probably the most important factors in determining children's choice and use of materials" and that the limited number of materials provided might also have an influence upon the child's choice, due to the necessity of substitution. Farwell (4) considered the addition of new materials an influencing factor in her study; the children seemed to prefer the new in preference to the old. Adult suggestion and the child's love of color may also influence his preferences.

Since looking at pictures is an activity which appeals to all children, and the ability to recognize single objects in pictures and to associate them with the real object comes, according to Stern (9) as early as 19 months of age, it occurred to the writers that a method might be developed which would make use of this natural and universal interest. The method of paired comparisons of pictures was selected.

The purpose of the investigation was twofold: to determine the preferences of a group of preschool children for a series of pictures of play materials and to compare this order of preference with the order shown in spontaneous play on the playground and in a somewhat restricted play-room.

The subjects were 17 girls and 15 boys ranging in age from three years, six months to six years, four months. Fifteen of these were selected at random from the older group of children enrolled in the Iowa State College Nursery School. The remaining 17 were former pupils of the nursery school; 13 of these, at the time of the study were enrolled in the Ames Kindergarten and 4 were staying at home. The children were from the homes of the professional and business classes. The I.Q.s ranged from 96 to 150 with an average of 114.4.

The play materials selected for this study were chosen from the used materials of the Iowa State College

Nursery School. Consequently the children had had ample opportunity to become familiar with them. These were classified into 8 groups: playground apparatus, toys for active play, blocks, plastic materials, manipulative materials, and toy animals. Six specific play materials or toys were selected for each group, making a total of 48 individual items.

These materials were photographed by the college photographer. Similarity in background, lighting and proportion were considered. The pictures were mounted separately on neutral gray card-board 5¼ by 6¼ inches. They were numbered and lettered appropriately to facilitate presentation and tabulation.

A small stand 14 x 7 inches was designed for presenting the pictures. This was elevated 2 inches in the back, thus making a slanting position toward the child. A small molding was tacked to the lower edge and to this was hinged a piece of glass, the edge of which was bound with tape. This glass extended one-half an inch over the top edge of the board which made it easy to lift up and down thus simplifying the process of placing the pictures under it. The board was covered with a neutral gray background.

The pictures were presented to the children at the various schools which they happened to be attending. In all cases the rooms were well ventilated and lighted, and the children were as far removed from distractions as possible. The tables and chairs were adjusted to the child's stature. The comfort of the child, his position and the effect of the light on the pictures were made as optimum as possible.

A preliminary test, using the pictures of one group of play materials was given to ten of the nursery school children. These pictures were presented according to the order recommended by Seashore (8), comparing each picture consecutively with every other one.

An examination of the results showed a general tendency for the subjects to choose the new picture in preference to the one that was shown consecutively. Such remarks as "Why do you keep showing that one?" and "Why there's the same picture again" were quite common. This suggested the advisability of working out a new order of presentation in which no picture was shown twice in succession at the same sitting.

The general plan of procedure was to give each child one complete test which was followed by a retest, not sooner than one week, nor later than three. One complete test consisted of a comparison of each specific play material in a group with each of the other 5 within its own group. The material preferred first in each group was then compared with the first preference of every other group. For the younger children the test was divided into 4 parts and given on consecutive days whenever possible, but for the kindergarten children and those tested in the homes the test was completed in 3 sittings. The same procedure was followed for the retest.

Upon presenting the pictures to the subject for comparison, the examiner allowed the child to look at them for a few seconds. Then if he did not call spontaneously the name of the play material, he was asked: "What do you see in these pictures to play with?" A record was kept of the ones the child could not name. If he seemed unable to name the material he was asked, "What do you do when you play with these?" If the child could name or could tell how to use the equipment, he was checked as being able to recognize that material. The next question was, "Which one of these playthings do you like to play with best?" Some children were more hesitant than others about answering so the direction took the form of, "Place your finger on the one you like to play with best." This usually brought about a response, however, in some cases the finger was placed on one picture and then on the other. In a case of this kind the examiner repeated her request with a little more emphasis upon the word "one." After this the first picture pointed out by the child was considered his preference. Should a child contend that he liked both, he was asked, "If you were to play with both of these playthings which one would you play with first?" His choice then made was considered his preference.

In addition to the paired comparisons of pictures, an observation study was conducted of the child's choice of certain of the actual play materials. Fourteen of the same nursery school children, 6 girls and 8 boys, who were used in the picture test were allowed to play for 15 minutes, one at a time, in a room in which the plastic group of materials had been arranged. These materials were arranged as nearly like the pictures as possible and grouped about the room so the child would have all in full view upon coming through the door. He was told, "Here is a room full of playthings; you may play with whatever you want to." If he asked what to do or seemed at a loss as to what to do next, the examiner merely made the statement, "Play with whatever you like." The position of the materials was changed several times in order to equalize any possible advantage of one position over another. Bridges (3) method was used for recording the name of each material used, its order of use, and the amount of time spent with each. The findings of this controlled observational study were compared with the group preferences for the same group of play materials as determined by the method of paired comparisons of pictures.

As a further phase of the present investigation, the writers attempted to determine if the play materials which the subjects had at home influenced their choices of materials in the picture test. Information was collected through an interview with the mothers regarding the kinds of materials that were accessible in the homes. The mothers were also asked to rank, from the list of play materials used in the present study, the child's preferences for those materials found in the home. The specific materials were ranked within each group, and then the first preferences of each group ranked with the first preferences of the other groups. This later information was purely opinion of the mothers, but due to daily observations of the children's activities, it was thought that the mother's opinions might prove worthy of comparisons with the children's preferences as determined by the other methods.

RESULTS

The picture test. Reliability of the method: The reliability of the method of paired comparison of pictures was determined by correlating the choices the children made in the first test with the choices they made in the retest. The total number of times each of the 42 specific materials was chosen in the first was correlated with the total number of times each of these was chosen in the retest.

The correlation for the four-year-old group was .78 ±04; for the five-year-old group, .68 ±.05; for the six-year-old group, 95 + .09; and for the total group, .87 ±.02. It is to be noted that the correlation for the five-year-old group is somewhat lower than for the other two groups. This may be due in part to three things: (1) the group was much smaller, (2) three out of seven of the subjects in this group were tested in their homes where it was impossible to control conditions as well as at school, and (3) this group also contained the three children who did not coöperate readily in the testing, and who became negative toward the last of the testing procedure.

Preferences among play materials. The total number of times each specific material was chosen in the first picture test was averaged with the total number of times the same material was chosen in the retest. These averages were used as the basis for ranking the preferences among play materials, the highest average being considered first preference; the next highest, second preferences, and so on down to the least preferred.

In table 1 is shown the order of preference for each specific material within its own group by children of different ages. The materials are listed in order from the most preferred to the least preferred. When the averages of two or more materials were the same, these were grouped together showing a tie for the position. The three ages show the closest agreement with the large toys for active play, among which, with one exception, their preferences are identical. The greatest disagreement is among transportation miniature toys. In the latter case, the averages from which the rankings were determined ran very close together, showing that there were very few decided preferences for any particular toy within this group of play materials.

Swings and rings rank high at all ages. The jungle gym is popular; while the packing boxes are the least preferred at all ages. There is a decided preference for the tricycle, sled and rocking horse chair at all ages, while the kiddy car has the lowest rank for all the groups. Small cubes hold an important place in all age groups. When comparing the plastic materials it may be noted that the first three preferences remain the first 3 for all ages and the last 3 are the same for all ages. Clay, work-table and tools, and water-colors are preferred to easel and paints, black-board and chalk, and scissors and paper.

Among the manipulative materials, the popularity of the ball is shown. Among the housekeeping materials.

TABLE 1

Order of preference for each specific play material within groups by children of different ages

FOUR-YEAR-OLDS	FIVE-YEAR-OLDS	SIX-YEAR-OLDS
	Playground apparatus	
Swings and rings	Bar	Swings and rings
Jungle gym	Swings and rings	Jungle gym
Slide	Jungle gym; see-saw	Slide; see-saw
See-saw; bar	....	....
....	Slide	Bar
Packing boxes	Packing boxes	Packing boxes
	Large toys for active play	
Tricycle	Tricycle	Tricycle
Sled	Sled	Sled
Rocking-horse chair	Rocking-horse chair	Rocking-horse chair
Wheelbarrow	Wheelbarrow	Wagon
Wagon	Wagon	Wheelbarrow
Kiddy kar	Kiddy kar	Kiddy kar
	Blocks	
Patty Hill floor blocks	Small cubes	Small cubes
Blocks and pegs	Bricks, etc.	Blocks and pegs
Small cubes	Hollow boxes	Patty Hill floor blocks
Hollow boxes	Blocks and pegs	Nest of boxes
Bricks, etc.	Patty Hill floor blocks; nest of boxes	Bricks, etc.
Nest of boxes	....	Hollow boxes
	Plastic materials	
Worktable and tools	Clay	Clay
Water colors	Worktable and tools	Worktable and tools
Clay	Water colors	Water colors
Easel and paints	Scissors and paper	Easel and paints
Blackboard and chalk	Blackboard and chalk	Blackboard and chalk
Scissors and paper	Easel and paints	Scissors and paper
	Manipulative materials	
Peg-board ($\frac{1}{8}$ in.)	Ball	Ball
Ball	Peg-board ($\frac{1}{8}$ in.)	Tower
Tower	Tracing frames	Beads
Beads	Tower	Peg-board ($\frac{1}{8}$ in.)
Tracing frames	Beads	Tracing frames
Peg-board ($\frac{3}{4}$ in.)	Peg-board ($\frac{3}{4}$ in.)	Peg-board ($\frac{3}{4}$ in.)

TABLE 1—*Continued*

FOUR-YEAR-OLDS	FIVE-YEAR-OLDS	SIX-YEAR-OLDS
	Transportation miniature toys	
Bus	Train	Train; aeroplane
Tractor	Truck	....
Truck	Car	Tractor
Train	Tractor; bus	Bus
Car	....	Car
Aeroplane	Aeroplane	Truck
	Housekeeping materials	
Washing equipment	Doll buggy	Telephone; doll buggy
Doll buggy	Tea-set, table and chair	....
Telephone	Telephone; doll bed	Washing equipment
Tea-set, table and chair	....	Tea-set, table and chair
Doll bed	Washing equipment	Doll bed
Doll	Doll	Doll
	Toy animals	
Small animals	Small animals	Small animals
Cow	Teddy bear	Teddy bear
Sheep	Elephant; sheep; duck	Elephant
Elephant	....	Duck on rollers
Duck on rollers	....	Sheep
Teddy bear	Cow	Cow

the doll buggy and the telephone rank high at all ages. There is a uniform low preference shown for the doll.

Table 2 shows the order of preference for each specific material within its group according to sex and total group preference. The most noticeable differences are: (1) girls prefer the smaller blocks, while boys choose the larger ones; (2) interest in the work-table is high for boys, but low for girls; (3) girls show more preference for scissors and paper; and (4) boys rank the doll buggy, washing equipment, and doll as their lowest preferences among housekeeping materials, while they rise to first preference for girls.

The order of preferences among the materials as shown for the total group is similar to that found for the age groups. The swings and rings, tricycle, small cubes, clay, ball, train, doll buggy, and small animals hold first preference for their respective groups of materials. The packing boxes, kiddy car, nest of cubes, blackboard and chalk, peg-board, car, doll, and cow are placed as least preferred among their respective groups.

The order of preference for the eight different classes or groups of play materials for all children is as follows: plastic materials, toy animals, housekeeping materials, playground apparatus, large toys for active play, manipulative materials, transportation miniature toys, and blocks. In compar-

TABLE 2

Order of preference for each specific play material within groups by different sexes and by total group

BOYS	GIRLS	TOTAL GROUP
Playground apparatus		
Jungle gym	Swings and rings	Swings and rings
Swings and rings	See-saw	Jungle gym
Bar	Jungle gym	See-saw
Slide	Bar	Bar
See-saw	Slide	Slide
Packing boxes	Packing boxes	Packing boxes
Large toys for active play		
Sled	Tricycle	Tricycle
Tricycle	Rocking-horse chair	Sled
Wagon	Sled	Rocking-horse chair
Wheelbarrow	Wheelbarrow	Wagon
Rocking-horse chair	Wagon	Wheelbarrow
Kiddy kar	Kiddy kar	Kiddy kar
Blocks		
Hollow boxes	Small cubes	Small cubes
Patty Hill floor blocks	Blocks and pegs	Blocks and pegs
Bricks, etc.	Patty Hill floor blocks	Patty Hill floor blocks
Small cubes	Nest of boxes	Hollow boxes
Blocks and pegs	Bricks, etc.	Bricks, etc.
Nest of boxes	Hollow boxes	Nest of boxes
Plastic materials		
Worktable and tools	Water colors	Clay
Clay	Clay	Worktable and tools
Water colors	Scissors and paper	Water colors
Blackboard and chalk	Easel and paints; and work-table	Easel and paints
Easel and paints	Blackboard and chalk	Scissors and paper
Scissors and paper		Blackboard and chalk
Manipulative materials		
Ball	Ball	Ball
Peg-board ($\frac{1}{8}$ in.)	Peg-board ($\frac{1}{8}$ in.)	Peg-board ($\frac{1}{8}$ in.)
Tower	Beads; tower	Tower
Tracing frames; beads	....	Beads
....	Tracing frames	Tracing frames
Peg-board ($\frac{3}{4}$ in.)	Peg-board	Peg-board ($\frac{3}{4}$ in.)

TABLE 2—*Continued*

BOYS	GIRLS	TOTAL GROUP
	Transportation miniature toys	
Tractor	Train	Train
Train	Truck	Tractor
Aeroplane	Bus	Bus
Truck	Car	Truck
Bus	Tractor; aeroplane	Aeroplane
Car	....	Car
	Housekeeping materials	
Telephone	Doll buggy	Doll buggy
Doll bed	Washing equipment	Telephone
Tea-set, table and chair	Telephone	Washing equipment
Doll buggy	Doll	Tea-set, table and chair
Washing equipment	Tea-set, table and chair	Doll bed
Doll	Doll bed	Doll
	Toy animals	
Small animals	Small animals	Small animals
Elephant	Teddy bear; duck	Teddy bear
Teddy bear	....	Elephant
Sheep	Elephant	Duck on rollers
Cow	Cow	Sheep
Duck on rollers	Sheep	Cow

ing the boys preference with the girls of all ages, the preferences for housekeeping materials by the girls is very much in evidence, while the boys rank these low. There is a decided preference for plastic materials by the girls. Transportation miniature toys are ranked higher by the boys of all ages, than by the girls. Blocks are the least preferred play materials for both sexes and all ages, with one exception.

It may be noted further that the preference for toy animals tends to decrease with advance in age, while the preference for plastic materials increases; interest in housekeeping materials remains about the same for all ages; preference for transportation miniature toys is low for all ages; and blocks are the least preferred by all groups.

Choice of the actual materials. The theoretical preference of the fourteen children for the actual materials was determined in three ways: (1) by the number of times each material was used, (2) by the time each was used, and (3) by the order of use. These various methods correlate with the preferences as determined by the picture test, .43, .59, and .47 respectively. It appears that the time that the material was used correlates better with the picture test than the number of times used or the order of use. However, the number of subjects is so small these correlations are not significant.

In both the picture tests and the actual use of materials the preference for water colors, work table and tools and clay is high, while the preferences for easel and paints, and blackboard and chalk remain low.

TABLE 3

Comparisons of total sex preferences among the groups of play materials and the total group preferences

BOYS	GIRLS	TOTAL GROUP
Plastic materials	Housekeeping materials	Plastic materials
Toy animals	Manipulative materials	Toy animals
Playground apparatus	Playground apparatus	Housekeeping materials
Large toys for active play	Toy animals	Playground apparatus
Transportation miniature toys	Plastic materials	Large toys for active play
Housekeeping materials	Large toys for active play	Manipulative materials
Manipulative materials	Transportation miniature toys	Transportation miniature toys
Blocks	Blocks	Blocks

TABLE 4

Comparisons of age preferences among the groups of play materials

FOUR-YEAR-OLDS	FIVE-YEAR-OLDS	SIX-YEAR-OLDS
Toy animals	Plastic materials	Plastic materials
Housekeeping materials	Toy animals	Playground apparatus
Large toys for active play	Housekeeping materials	Housekeeping materials
Playground apparatus; plastic materials		Large toys for active play; toy animals
....	Playground apparatus; large, toys for active play	....
Transportation miniature toys	....	Manipulative materials
Manipulative materials	Transportation miniature toys	Transportation miniature toys
Blocks	Blocks	Blocks

Relation of preferences to toys in the home. Of the 321 first preferences, 59 per cent were found in the home; of the 417 lowest ranks, 37 per cent were found in the home. These percentages indicate a slight tendency on the part of the child to prefer materials which he has at home; and to prefer the least those toys which he does not have at home. Blocks which were the least preferred are found in the least number of homes. However, an insignificant correlation of .19 was obtained between the ranking of the materials found in the largest number of homes and the children's preferences as determined by the picture tests. A correlation of .40 was obtained between the mother's rankings and the children's.

Comparison with other studies. It is interesting to note how the results of

[illegible]

the present investigation compare with the results of previous investigations. There is agreement in that:

(1) The interest in clay and housekeeping materials is high for all ages; (Garrison (5) and Bott (1))

(2) Similarity of interest in play materials by all ages is greater than the differences, however, there is a gradual change of interest with advance of years; (Bott (1), Farwell (4), and Van Alstyne (10)).

(3) The kiddy car is ranked low by the older children; (Hulson (6) and Bott (1)).

(4) Boys show a higher preference for woodwork, larger blocks, and materials which require larger muscle activity, while girls show a higher preference for housekeeping materials and materials for more passive play; (Bridges (2) (3), Van Alstyne (10), and Garrison (5)).

(5) Preference for clay is high for both sexes. (Garrison (5)).

There is a difference in that:

(1) Blocks are ranked as the least preferred by the age groups, sexes and total group in the present study, whereas, in previous investigations conducted by Garrison (5), Hulson (6), Bridges (3) and Van Alstyne (10) they were ranked as high preference;

(2) A higher preference for locomotor toys, or large toys for active play, playground apparatus, and toy animals tends to be more evident in the present study.

(3) The high preference for the train which was manifested in Bott's (1) investigation is not evident in the present study.

In conclusion, the paired comparisons of pictures has some value as a method in determining the preferences of children for certain types of materials. The technique has value as a laboratory exercise for students in child psychology. It appears concrete and definite and affords opportunity for direct contact with the individual child.

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Undesirable Behavior Traits in Junior High School Students

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STUDIES of adolescent behavior problems have been many, but, for the most part, have been limited to generalized observations. What studies have been made from a scientific point of view have indicated that there is a relationship between undesirable behavior and chronological age; that specific forms of undesirable behavior are accompanied by certain characteristic forms of behavior, and that there are sex differences to be found in these. It was with the hope of throwing further light on these conclusions that the present study was undertaken.

HISTORICAL BACKGROUND

Monroe (7) who was interested in the social element of school life, made, in 1899, a statistical study of the qualities children desire in their companions. Following this came a number of questionnaire studies of children's behavior, ideals and ambitions, but most of these lacked a systematic point of view.

In 1916, when the College of Education of the University of Minnesota, in coöperation with the Medical School, opened a clinic for the mental and educational examination of children, Wickman et al. (10) carried out a series of studies of early behavior disorders. Teachers were asked to list all kinds of behavior problems prevalent in the children in their classes. Four hundred and twenty-eight different items were mentioned which, when classified, numbered about fifty. The teachers were then asked to rate their pupils on behavior records made up of their problem cases, and also on a behavior and personality chart devised by Wickman. The total incidence of behavior problems of the 874 children studied was then computed in terms of percent, the highest of which were whispering (74.7 per cent); inattention (59.0 per cent); carelessness (44.0 per cent) and tattling (42.0 per cent); the lowest were suspicion (2.1 per cent); cruel bullying (1.7 per cent); truancy (1.6 per cent) and temper outbursts (1.5 per cent). Sex differences in troublesome behavior showed it to be much less frequent in girls than in boys. The peak of troublesome behavior for boys was 11 years and for girls, 13 years.

Blatz and Bott (2) carried out a study modelled along the lines of Wickman's study, but which carried the observation of the children studied over a number of years. Some of the outstanding results of their study indicated that the peak of misdemeanors came from 13–14 years, indicating a pre-adolescent trend; that the number of misdemeanors falls off markedly with age, and that the frequency is not clearly related to chronological age, but varies inversely with the intelligence quotient for boys, but not for girls.

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[1] The senior author supervised the study and prepared the manuscript for publication; the junior author collected the data and presented them as a Master's Essay in Columbia University.

McClure (6) studied the characteristics of the problem children in grades 4 to 6 of the Toledo schools. He found that the largest number of problem cases occurred in the sixth grade, which corresponds approximately to 11 and 12 years, chronological age. The problem child was found usually to be retarded in school, with mean I.Q. of 90, and an average of 7.7 undesirable traits. These were found to be; constantly annoying children nearby, not knowing how to study, excessive whispering, carelessness, general disobedience and disrespect of teacher, disorder during intermissions, and unreliability.

Leal (4) studied, by a means of questionnaires given to teachers, the relationship between physiological maturity and certain characteristic behavior traits of boys and girls. The behavior traits most frequently reported were impatience with restrictions, self-assertion, interest in the opposite sex, avoidance of the opposite sex, coöperation and gregariousness. She found all the traits she had listed occurring to a greater or lesser extent in all stages of development except in the case of gregariousness, which occurred in girls only in the matured age.

Wilson (11) had two psychology students visit classrooms between 9 and 10 o'clock for ten consecutive observations to determine how much whispering occurs. From these observations, he concluded that "the gross amount of whispering in a particular grade was a function of the situation rather than the reflection of any fundamental developmental continuum."

Ackerson (1) studied the behavior problems in the home and neighborhood by obtaining data concerning these from parents. He used 139 traits which he grouped into "personality" and "conduct" categories. The two outstanding conclusions are that behavior problems increase with age up to about the years 9 to 13, when there is a decrease; and that each form of behavior, when studied individually, manifested its own type of relation with chronological age and I.Q.

From the studies summarized briefly above, and chosen from the many dealing with the general problem of behavior studies because of their specific relationship to the problem to be reported herewith, it is apparent that there is a relationship between chronological age and behavior, and also, that there is a sex difference in many behavior traits.

PRESENT STUDY

The purpose of the study to be reported below was to find if there is a relationship between chronological age and specific behavior traits, if any sex differences exist in these, and to find the relationship between a specific trait and other traits.

In order to obtain facts for this study, the opinions of teachers concerning the prevalance of undesirable behavior traits among their pupils had to be relied upon. No doubt, prejudice to a certain degree influenced their opinions but, as the interest of the writers was in representative groups of boys and girls of specific ages, rather than in individual students, these distorted opinions may, to a certain extent, be counteracted by opinions of a too favorable sort.

The school in which the present study was made is a Junior High School in the Upper Bronx, New York City. It is located in a fairly well-to-do neighborhood and the students are predominately Jewish. From this school, 790 children, of whom 438 were boys and 352 girls of the ages eleven to fourteen inclusive, were selected to be studied. Because the numbers of students older than fourteen and younger than eleven were too small to justify drawing conclusions from a study of their behavior, they were not included in the present study. The distribution of subjects is presented in table 1.

TABLE 1

Distribution of subjects

AGE	BOYS	GIRLS	TOTAL
11	94	84	178
12	152	132	284
13	96	76	172
14	96	60	156
Total...	438	352	790

At the beginning of the fall term each classroom teacher was given a list of the thirty-seven behavior traits which she was to look for in her pupils during the term. Classroom teachers were chosen because they meet their groups under more similar circumstances than substitute teachers do, and they are in a position to become better acquainted with their pupils. All the traits listed are found in Wickman's (10) behavior scale; some of his have been excluded however, for his research concerned itself with an entire school population and contained many traits "outgrown" and not found in older children. At the end of the term the teacher was asked to check for each pupil in the class the list of traits given on the Behavior Inventory, as shown on page 281.

Results. Table 2 shows the incidence of the behavior traits studied. The data were obtained by counting the number of children having each specific trait and then by finding what per cent that number is of the total number of children. The results for boys and girls were kept separate. As traits 11, 12, 13, 14 and 36 were not reported for any of the children studied, they are, therefore, not included in the tables.

In this table, it may be observed that the traits occurring most often in boys are whispering, inattentiveness, carelessness, failure to prepare and interrupting; those which occurred least often are destruction or abuse of school property, cruelty, truancy, easily-frightened and insubordination. In girls, whispering, inattentiveness, carelessness, lack of interest and day-dreaming head the list of undesirable behavior traits; those occurring least frequently are cruelty, destruction of school property, bullying other children and insubordination to the authority of the teacher.

Table 3 shows the relationship, in

BEHAVIOR INVENTORY

Name..

Age..

TRAITS	HAS OCCURRED ONCE OR TWICE	OCCURS WITH OCCASIONAL FREQUENCY	HAS BECOME ALMOST HABITUAL
1. Suspiciousness			
2. Resentfulness			
3. Fearfulness			
4. Cruelty			
5. Tendency to depression			
6. Tardiness			
7. Truancy			
8. Destruction or abuse of school property			
9. Lying			
10. Cheating in school work			
11. Stealing			
12. Swearing			
13. Smoking			
14. Talking—writing obscene notes—pictures			
15. Whispering			
16. Interrupting by impromptu recitations, etc.			
17. Inability to work calmly			
18. Inattentiveness			
19. Lack of interest			
20. Careless or inaccuracy			
21. Failure to prepare			
22. Laziness			
23. Disobedience (willful)			
24. Insubordination to teachers authority			
25. Bullying other children			
26. Tattling			
27. Stubbornness			
28. Temper-tantrums			
29. Rudeness to others			
30. Shy, withdrawing type			
31. Over-sensitive			
32. Showing off			
33. Day-dreaming			
34. Nervousness			
35. Easily frightened			
36. Tomboy girl—sissy boy			
37. Easily led, suggestibility			

per cent, of the frequency of undesirable behavior to chronological age. The figures in this table were obtained by weighting the frequency of occurrence of each trait. For example, rudeness was a trait noticeable in 44 out of 438 boys, thus giving an incidence percentage of 9.8. Some of the boys were rude once or twice; others showed rudeness with "occasional frequency," while in others, the trait "had become almost habitual." The writers therefore weighted each degree of frequency 1, 2, and 3 respectively, and, by multiplying the number of cases under each heading by its respective frequency number and adding the three, the frequency score for that trait was obtained. To illustrate: in rudeness, 32 of the cases occurred once or twice; 11 with occasional frequency and only one had become almost ha-

TABLE 2

Incidence chart; showing the relationship (in per cent) of the incidence of undesirable behavior to chronological age

NUMBER	NAME OF TRAIT	BOYS					GIRLS				
		Age 11	Age 12	Age 13	Age 14	Total per cent	Age 11	Age 12	Age 13	Age 14	Total per cent
		Number in each group					Number in each group				
		94	152	96	96	438	84	132	76	60	352
1	Suspiciousness	8.5	10.5	14.6	17.7	12.6	4.8	6.1	6.6	20.0	8.2
2	Resentfulness	22.3	13.8	16.6	33.3	20.5	6.0	18.2	11.8	27.0	15.3
3	Fearfulness	6.4	13.1	4.2	12.5	9.5	2.4	9.8	7.9	8.3	7.4
4	Cruelty	0	0.7	4.2	3.1	1.8	0	0	0	0	0
5	Tendency to depression	4.2	8.5	14.6	18.8	11.2	4.8	6.1	6.6	6.9	6.0
6	Tardiness	26.5	30.3	29.1	30.2	29.2	9.5	14.4	23.8	6.9	13.9
7	Truancy	1.1	2.0	4.2	10.4	4.3	2.8	2.3	2.6	5.0	2.8
8	Destruction or abuse of school property	0	0	0	2.1	0.5	0	0	0	0	0
9	Lying	12.7	5.3	8.3	8.3	8.2	4.8	3.0	4.2	0	3.1
10	Cheating	10.6	27.6	31.2	26.1	24.4	17.9	25.0	18.4	16.7	17.3
15	Whispering	75.2	84.2	70.7	62.5	74.7	66.6	86.4	60.5	65.0	72.4
16	Interrupting	11.7	19.7	45.7	45.9	29.4	9.7	15.2	18.4	0	9.7
17	Inability to work calmly	11.7	16.5	29.1	20.8	19.2	7.1	18.2	10.5	10.0	12.5
18	Inattentiveness	27.0	48.7	45.7	51.1	44.1	14.3	46.2	44.0	36.7	36.6
19	Lack of interest	14.9	28.9	16.6	37.5	27.4	14.3	40.9	23.8	21.7	27.6
20	Carelessness	25.5	46.1	43.7	39.6	39.7	15.5	51.5	40.8	23.3	35.8
21	Failure to prepare	28.1	38.9	41.6	42.1	37.4	2.4	24.2	15.8	13.3	15.3
22	Laziness	6.4	25.0	29.2	29.2	22.8	2.4	10.6	13.2	15.0	12.2
23	Disobedience	8.5	11.9	16.6	14.6	12.8	2.4	4.5	7.9	8.3	5.4
24	Insubordination	3.2	2.6	7.3	10.4	5.5	0	.8	2.6	6.7	2.0
25	Bullying others	4.3	3.9	13.5	6.3	6.6	1.2	1.5	0	3.3	1.4
26	Tattling	6.4	13.8	6.2	8.3	9.4	3.6	16.0	17.1	15.0	12.8
27	Stubbornness	9.5	19.7	14.6	27.1	18.0	0	10.6	13.2	20.0	10.2
28	Temper-tantrums	6.4	14.5	4.2	11.4	9.8	0	9.1	4.2	1.7	4.5
29	Rudeness to others	6.4	7.3	15.6	18.8	10.0	0	4.6	2.6	3.3	2.8
30	Shy, withdrawing	19.1	30.3	16.8	12.5	21.0	21.4	30.3	34.2	25.0	28.1
31	Over-sensitive	6.4	22.4	6.2	12.5	13.2	2.4	9.8	15.8	20.0	11.1
32	Showing-off	9.5	11.9	34.4	29.2	20.1	1.2	4.5	5.3	16.7	6.0
33	Day-dreaming	4.3	26.3	22.9	21.8	19.9	8.3	22.7	27.6	23.3	23.5
34	Nervousness	10.6	11.9	18.7	16.7	14.2	0	6.1	10.5	6.7	5.7
35	Easily frightened	6.4	7.4	4.2	3.2	5.5	0	5.3	10.5	16.7	7.1
37	Suggestibility	6.4	6.6	5.2	12.5	7.6	2.4	6.1	4.0	13.3	6.0

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(1 × 3) = 57, the

ness, which is 13 per
boys.
, that the behavior
ident in eleven-year-

old boys than in any of the older boys. Fourteen seems to be the most troublesome age. Those traits that show an increase with age are suspiciousness, tendency to depression, truancy, interrupting, failing to pre-

TABLE 3

n per cent) of the frequency of undesirable behavior to chronological age

F TRAIT	BOYS					GIRLS				
	Age 11	Age 12	Age 13	Age 14	Total per cent	Age 11	Age 12	Age 13	Age 14	Total per cent
	Number in each group					Number in each group				
	94	152	96	96	438	84	132	76	60	352
ss	10.6	11	0.5	18	13.0	4.8	6.1	6.6	20.0	8.2
s	26.6	18	19	40	24.7	7.1	18.2	11.8	30.0	16.2
	6.4	16	4	17	11.4	2.4	9.9	7.9	11.7	8.0
	0.0	1	6	3	2.3	0.0	0.0	0.0	0.0	0.0
depression	4.3	9	15	22	11.9	4.8	3.8	6.6	6.7	6.0
	45.7	43.5	33	40	40.9	9.6	16.7	28.9	10.0	16.4
	1.0	1	6	17	5.9	3.6	4.6	5.3	8.3	5.2
r abuse of erty	0.0	0	0	2	0.5	0.0	0.0	0.0	0.0	0.0
	15.0	5	3	8	8.9	4.8	3.0	3.9	0.0	3.1
	17.0	33	35	26	28.5	17.8	28.0	21.0	16.7	22.1
	12.4	13.6	11.0	89	118.0	83.3	132.0	108.0	93.3	108.0
	16	28	59	56	38.3	0.0	15.9	21.1	0.0	10.5
work calmly	17	26	40	24	37.9	7.1	19.7	15.8	10.0	14.2
ss	33	62	57	57	53.8	14.2	56.0	61.8	46.7	45.8
est	19	39	21	46	32.2	17.8	52.3	31.6	33.3	36.4
	33	65	72	55	57.3	17.8	60.6	59.2	33.3	45.5
epare	33	41	48	47	42.0	4.8	31.1	21.0	16.7	20.1
	8.5	34	39	40	30.9	4.8	28.1	18.4	20.0	19.0
	11	13	23	21	16.4	2.4	4.5	7.9	8.3	5.4
ion	5	3	11	13	7.3	0.0	0.8	2.6	6.7	2.0
	6	4	16	6	7.5	1.2	1.5	0.0	3.3	1.4
	6	15	6	8	9.8	3.6	17.4	19.7	15.0	14.2
	14	26	23	37	22.9	0.0	10.6	13.2	30.0	11.9
ums	85	16	4	14	11.2	0.0	9.1	4.0	1.7	4.5
others	6	7	22	20	13.0	0.0	4.6	2.6	3.3	2.8
wing	22	36	19	12	24.2	30.8	36.4	38.2	30.0	34.5
e	6	30	6	12	16.0	4.8	11.4	15.8	23.3	12.8
	20	14	55	37	20.5	1.2	4.6	5.3	16.7	6.0
g	11	32	31	24	25.5	10.7	28.1	39.5	36.7	27.8
	17	16	21	19	17.8	0.0	7.6	15.8	6.7	7.4
ned	8.5	9	4	5	6.9	0.0	5.3	10.5	23.3	8.2
	8.5	8	5	14	8.7	2.4	6.1	4.0	15.0	6.3

pare, laziness, rudeness, and suggestibility. These traits reach their peaks at fourteen for this age group. However, 14-year-old boys are much less sensitive, shy, fearful, talkative and tattling than are twelve-year-old boys. Those traits that reach their peak at thirteen are cheating, inability to work calmly, disobedience, bullying, showing off and nervousness. Fearfulness, whispering, carelessness, tattling, temper-tantrums, shyness, over-sensitiveness, day-dreaming and easily frightened occur in greater percentages in twelve-year-old boys. Only one trait, lying, is more evident in the 11-year-old group.

The 11-year group again evidences fewer of the undesirable behavior traits studied when comparing the age differences in girls. The traits showing increasing percentages with increasing age are suspiciousness, tendency to depression, truancy, laziness, disobedience, insubordination, stubbornness, over-sensitiveness and showing off. Here again there are no traits which show a decided falling off, but the fourteen year group is less tardy, whispers less, shows less inability to work calmly, lack of interest, carelessness and temper-tantrums than do their 12-year-old colleagues.

Highest percentages are reached in the 14-year-old group in suspiciousness, resentfulness, laziness, stubbornness, over-sensitiveness, showing off and suggestibility. In the thirteen year group, high percentage for the trait is found in interrupting, tattling, shyness, day-dreaming and nervousness. The 12-year-olds show the highest for fearfulness, tardiness, cheating, whispering, inability to work calmly, inattentiveness, lack of interest, carelessness, failure to prepare, temper-tantrums and rudeness. Though the per cent itself is very small, lying again seems to be the only trait in which the 11-year-olds surpass the others.

In comparing the results for the two sexes, it is apparent that 11-year-old girls show more cheating, shyness, and day-dreaming than boys. However the boys surpass them for nearly every other trait except lack of interest, which they both reveal to the same degree. Resentfulness, lack of interest, carelessness and tattling are more prevalent in 12-year-old girls than in boys of the same age, who show stubbornness, over-sensitiveness and showing-off. They are most alike in the following traits; truancy, cheating, whispering, inability to work calmly, inattentiveness, shyness, day-dreaming and suggestibility.

Thirteen-year-old boys and girls reveal about the same degree of tardiness, inattentiveness, carelessness, and stubbornness. They are not alike in fearfulness, lack of interest, tattling, shyness, over-sensitiveness, day-dreaming and suggestibility, in which traits the girls surpass the boys. In cheating, tendency to depression, lying, whispering, interrupting, failure to prepare, laziness, disobedience, bullying, rudeness and showing off the boys surpass the girls.

By comparing the two 14-year-old groups, it becomes evident that they are quite alike in the amount of whispering and day-dreaming they do. So is one about as easily led as the other. The girls are more suspicious, tattling, shy, and sensitive.

The boys show more of all the other undesirable traits, especially tardiness, interrupting, inability to work calmly, inattentiveness, lack of interest, and showing off. This is not as surprising as it might seem if it were not known that the 14-year-old boys present the greatest amount of undesirable behavior traits for the age group.

The writers also considered some of the traits separately in an effort to show what traits appear coincidently with a specific trait. Interest prompted the selection from those traits that occur in about 20 per cent or more of the children. The frequency of occurrence was used in scoring for each trait. The scoring was accomplished in the following manner. Every time resentfulness, for example, was checked by the official teacher, it was recorded in the proper frequency column and all other traits accompanying it were scored also in proper columns. The following are the specific traits chosen for study and will be taken in the order named:

1. Resentfulness
2. Cheating
3. Whispering
4. Day-dreaming

The frequency of the specific trait is taken as 100 per cent for all purposes of comparison with other traits. If another trait appears with the same frequency as the specific one, it will show 100 percent, too. It happens occasionally that the percentage is more than 100. This shows in resentfulness, for instance; it indicates that resentful children are even greater whisperers than they are resentful.

TABLE 4

Resentfulness: the ratio (in per cent) of the frequency of the coincident traits to the frequency of resentfulness

NUMBER	NAME OF TRAIT	BOYS	GIRLS
1	Suspiciousness	31.9	31.6
3	Fearfulness	31.9	21.1
4	Cruelty	5.6	0.0
5	Tendency to depression	16.8	17.6
6	Tardiness	65.5	35.2
7	Truancy	7.5	14.0
8	Destruction or abuse of school property	1.9	0.0
9	Lying	26.2	14.0
10	Cheating	39.3	38.6
15	Whispering	142.0	184.0
16	Interrupting	46.9	21.1
17	Inability to work calmly	37.4	31.6
18	Inattentiveness	66.2	98.2
19	Lack of interest	56.1	8.7
20	Carelessness	67.2	66.6
21	Failure to prepare	57.1	45.6
22	Laziness	52.3	31.6
23	Disobedience	33.6	17.6
24	Insubordination	20.6	7.0
25	Bullying others	18.8	3.5
26	Tattling	15.0	42.1
27	Stubbornness	59.0	59.7
28	Temper-tantrums	31.9	21.1
29	Rudeness to others	20.6	14.6
30	Shy, withdrawing	13.1	14.0
31	Over-sensitive	16.8	17.6
32	Showing-off	40.2	28.1
33	Day-dreaming	26.2	52.5
34	Nervousness	29.9	21.1
35	Easily frightened	11.2	14.0
37	Suggestibility	20.6	24.5

Table 4 shows the results of the scoring for resentfulness. The coincident traits in the order of their frequency are:

Boys

	per cent
Whispering	142
Carelessness	67.2
Inattentiveness	66.2
Tardiness	65.5
Stubbornness	59
Failure to prepare	57.1

Lack of interest	56.1
Laziness	52.3

Girls

Whispering	184
Inattentiveness	98.2
Lack of interest	80.7
Carelessness	66.6
Subbornness	59.7
Day-dreaming	52.5
Failure to prepare	45 6
Tattling	42.1

TABLE 5

Cheating: the ratio (in per cent) of the frequency of the coincident traits to the frequency of cheating

NUMBER	NAME OF TRAIT	BOYS	GIRLS
1	Suspiciousness	28.9	25.6
2	Resentfulness	33.6	23.0
3	Fearfulness	14.4	18.0
4	Cruelty	4.8	0
5	Tendency to depression	22.5	10.2
6	Tardiness	57.8	20.5
7	Truancy	8.1	0
8	Destruction or abuse of school property	1.6	0
9	Lying	19.2	12.8
15	Whispering	126.0	154.0
16	Interrupting	72.9	23.0
17	Inability to work calmly	60.9	28.2
18	Inattentiveness	99.5	101.0
19	Lack of interest	62.6	92.2
20	Carelessness	102.5	108.8
21	Failure to prepare	70.4	46.2
22	Laziness	51.2	53.9
23	Disobedience	33.6	15.4
24	Insubordination	16.0	0
25	Bullying others	12.8	0
26	Tattling	14.4	25.6
27	Stubbornness	22.5	12.8
28	Temper-tantrums	9.6	2.6
29	Rudeness to others	24.1	2.6
30	Shy, withdrawing	24.1	38.5
31	Over-sensitive	23.2	20.5
32	Showing-off	50.4	5.1
33	Day-dreaming	40.0	66.7
34	Nervousness	32.0	7.7
35	Easily frightened	12.8	10.2
37	Suggestibility	24.1	20.5

What picture is obtained of the resentful child? It might be said that the resentful child is a great whisperer. He is apt to be careless, inattentive and stubborn. He lacks interest in school work and therefore fails to prepare for it or vice versa. Both the girl and boy present somewhat the same picture. The girl is a greater whisperer; she is more inattentive and more disinterested. She is just as careless and stubborn, but besides she tattles and day-dreams. The resentful boy is probably lazier than the girl.

What about the child who cheats? What other characteristics does he seem to display? By studying table 5 the following traits are found characteristic of them.

Boys

	per cent
Whispering	126
Carelessness	102.5
Inattentiveness	99.5
Interrupting	72.9
Failure to prepare	70.4
Lack of interest	62.6
Inability to work calmly	60.9
Tardiness	57.8
Laziness	51.2
Showing-off	50.4

Girls

Whispering	154
Carelessness	108.8
Inattentiveness	101
Lack of interest	92.2
Day-dreaming	66.7
Laziness	53.9
Failure to prepare	46.2

The boy who cheats whispers less than the resentful boy, but he is much more careless and inattentive. He is also lazy and tardy quite regularly. He fails to prepare more often than the resentful boy and is quite unable to work calmly. He interrupts and shows off. The girl who cheats is a chronic whisperer though not as great a one as the resentful girl. She is very careless and inattentive. She shows no interest in her work, fails to prepare for it, in fact is too lazy to do so. Cheating to obtain grades seems to be the line of least effort. She would rather spend her time day-dreaming.

TABLE 6

Whispering: the ratio (in per cent) of the frequency of the coincident traits to the frequency of whispering

NUMBER	NAME OF TRAIT	BOYS	GIRLS
1	Suspiciousness	10.7	7.3
2	Resentfulness	18.5	14.4
3	Fearfulness	11.3	7.3
4	Cruelty	2.0	0.0
5	Tendency to depression	6.0	5.0
6	Tardiness	28.7	12.0
7	Truancy	3.3	4.4
8	Destruction or abuse of school property	0.4	0.0
9	Lying	6.6	3.1
10	Cheating	22.4	19.4
16	Interrupting	32.1	9.4
17	Inability to work calmly	19.5	9.4
18	Inattentiveness	43.9	41.4
19	Lack of interest	25.5	30.6
20	Carelessness	48.5	39.8
21	Failure to prepare	35.7	18.3
22	Laziness	26.3	17.6
23	Disobedience	13.1	5.0
24	Insubordination	6.6	1.6
25	Bullying others	6.4	1.3
26	Tattling	8.0	13.1
27	Stubbornness	17.0	11.0
28	Temper-tantrums	9.6	3.4
29	Rudeness to others	10.2	2.6
30	Shy, withdrawing	17.6	23.5
31	Over-sensitive	11.3	8.9
32	Showing-off	22.0	5.5
33	Day-dreaming	21.5	26.7
34	Nervousness	14.0	6.8
35	Easily frightened	5.5	5.2
37	Suggestibility	7.0	5.8

Table 6 reveals the accompanying undesirable behavior traits of some whisperers.

Boys

	per cent
Carelessness	48.5
Inattentiveness	43.9
Failure to prepare	35.7
Interrupting	32.1
Tardiness	28.7
Laziness	26.3
Lack of interest	25.5

Girls

Inattentiveness	41.4
Carelessness	39.8
Lack of interest	30.6
Day-dreaming	26.7
Shy—withdrawing	23.5

As the writers scored the many papers, they noted that there were many cases in which whispering was the only undesirable trait evident. Therefore it is difficult to say that certain traits are prevalent in most whisperers. However it can be said that if the whisperer has other accompanying undesirable traits, they are most likely to be carelessness, inattentiveness, and lack of interest. The boy whisperer might evidence some laziness, tardiness and failure to prepare; the girl, day-dreaming.

The last trait studied is day-dreaming. The results are presented in table 7. What are the accompanying traits?

Boys

	per cent
Whispering	119.7
Carelessness	117.8
Inattentiveness	92.8
Laziness	58
Lack of interest	50
Interrupting	57

Showing off	49
Failure to prepare	47.4
Inability to work calmly	47.4

Girls

Whispering	134.6
Inattentiveness	91.8
Carelessness	87.7
Lack of interest	65.3
Laziness	57.1
Failure to prepare	51

TABLE 7

Day-dreaming: the ratio (in per cent) of the frequency of the coincident traits to the frequency of day-dreaming

NUMBER	NAME OF TRAIT	BOYS	GIRLS
1	Suspiciousness	19.7	16.3
2	Resentfulness	21.4	24.5
3	Fearfulness	10.7	8.2
4	Cruelty	0.0	0.0
5	Tendency to depression	21.4	10.2
6	Tardiness	44.6	18.4
7	Truancy	9.8	13.3
8	Destruction or abuse of school property	0.0	0.0
9	Lying	12.5	2.0
10	Cheating	43.7	33.7
15	Whispering	119.7	134.6
16	Interrupting	57.1	24.5
17	Inability to work calmly	47.4	28.6
18	Inattentiveness	92.8	91.8
19	Lack of interest	50.0	65.3
20	Carelessness	117.8	87.7
21	Failure to prepare	47.4	51.0
22	Laziness	58.0	57.1
23	Disobedience	19.6	8.2
24	Insubordination	12.5	4.1
25	Bullying others	5.4	2.0
26	Tattling	12.5	16.3
27	Stubbornness	25.0	16.3
28	Temper-tantrums	14.3	0.0
29	Rudeness to others	17.0	4.1
30	Shy, withdrawing	29.5	35.7
31	Over-sensitive	31.4	24.5
32	Showing-off	49.1	12.2
34	Nervousness	36.6	12.2
35	Easily frightened	10.7	6.1
37	Suggestibility	16.1	18.4

Boys who are day-dreamers reveal almost the same degree of whispering and carelessness. They are just about as inattentive as girls who are day-dreamers; the girls being the greater whisperers, and lackers of interest. Both are unprepared, the chances are, for both are lazy. The girls tend more to shyness than to showing-off as the boys do.

SUMMARY AND CONCLUSION

Is there any relationship between chronological age and undesirable behavior traits? The evidence presented above indicates that there is, although the peaks for the ages showing the greatest number of undesirable traits do not agree with the studies by Wickman (10) or McClure (6). The peaks obtained in this study are 14 years for boys and 12 years for girls. In the case of Wickman's study, the peaks are 11 and 13 respectively, and in McClure's study, the age peak is at about 12 years. This difference may be explained partly by the fact that the children used as subjects for this study are predominately Jewish and that early maturing among the girls appears to be a characteristic trait, while among the boys, maturing is delayed. This may, to a certain extent, account for the fact that the 13 and 14-year-old girls are less troublesome than the 12-year-old group, while the boys continue to be troublesome to the age of 14 years at least.

In the Junior High School studied, the children are allowed more freedom than in the grammar grades; the 11-year-olds were for the most part in the first and second term of Junior High School and had not become accustomed to the new régime, and, therefore, seemed "very good" in comparison to the others who had been in the school for a longer time. Besides, the 11-year-old group was advanced in school for its age and contained, no doubt, the more serious, less troublesome child.

However the relationship the writers had in mind was not so much that between the amount of undesirable behavior and chronological age, as between specific traits and chronological age. The only traits they found in boys that seemed to bear no relation to age were fearfulness, temper-tantrums, and lack of interest. In girls, they were lack of interest, laziness, bullying other children and rudeness.

Most of the traits were present to some extent in every specific trait chosen for study. The relationship between them is primarily one of degree, therefore. The writers feel that some traits are 'universal' in that they seem to accompany all types of behavior, adult's as well as children's. Primary among these is whispering, about which they agree with Wilson (11) who concluded after studying whispering "that the gross amount of whispering . . . . was a function of the particular situation rather than the reflection of any fundamental continuum."

All traits evidenced whispering as an accompanying trait. The resentful child whispers most, probably an expression of his resentfulness. The child who fails to prepare is next, trying to get his lessons in school, perhaps. The cheater and inattentive child are next; the one whispering while cheating, the other merely not paying attention. Is it surprising to find the shy, with-drawing type evidencing the least amount of whispering?

The method of finding this relationship seems to be a reliable one, for it has borne out many accepted facts. For instance, the outstanding characteristics, i.e. the characteristics that belong more to one specific trait than others, of resentfulness are stubbornness and tardiness; cheaters show lack of interest and inattentiveness, and fail to prepare. As would be expected, inattentive children were found to be careless; and the careless, inattentive. Children who fail to prepare are lazy. The shy, with-drawing child is over-sensitive, and day-dreamers are careless, lazy and inattentive.

This study has convinced the writers that there is a definite relationship between undesirable behavior traits and chronological age, depending in a measure upon sex difference. A majority of the traits bear a relationship to other specific traits such as would commonly be induced from casual observation and pure reasoning. The remainder bear a relationship which, while not so apparent, is none the less definite and dependent to some extent upon mental age, racial characteristics, environment and other commonly accepted factors.

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Brief Report

A Note on Reaction Times in Infants

THE following note based on data incidental to another research (2) is a comparison of the reaction time of respiration with the reaction time of the body startle in 6 infants. The stimulus was a tone of 580 cycles, with a duration of .07 second and an intensity of 85 sensation units. The reaction time of the body startle was measured by the stabilimeter, and of respiration by a pneumograph attached to the abdomen of the infant. Both records were made on a polygraph tape. Fifty stimulations were given the 6 infants. With every stimulation a respiratory response was evoked, but 15 stimulations failed to produce a body startle although an 85 decibel tone is a fairly loud sound.

The average reaction time for respiration was .09 second, the standard deviation .029, and the standard error of the mean .004. The mean respiratory time for only those stimulations which gave startles was .09 second, the standard deviation .027, and the standard error of the mean .005. In each of these cases the respiratory reaction time was less than the corresponding time for the startle. The average reaction time of the body startle was .19 second, standard deviation .14, and standard error of the mean .025. The value of .19 second compares well with the value of .18 second reported in a previous study (1). The mean reaction time of the body startle, therefore, is about twice that for respiration.

A glance at the standard deviations of the two values suggests that the reaction time of respiration is the less variable measure. In order to compare the variability of these measures Pearson's coefficient of variability was used. The reaction time of respiration was found to be 44 per cent as variable as that of the startle response.

These data do not represent large samplings but the fact that the value for the startle reaction is practically the same as previously reported indicates that the sampling probably is adequate. The value for respiration needs to be checked before a similar statement can be made. However, the fact that the average value for only those cases giving a startle is the same as average of the total number of respirations suggests its reliability.

Perhaps the most interesting finding is the fact that with a loud tone the startle response occurs in only 70 per cent of the stimulations, whereas the respiratory response occurred 100 per cent of the time.

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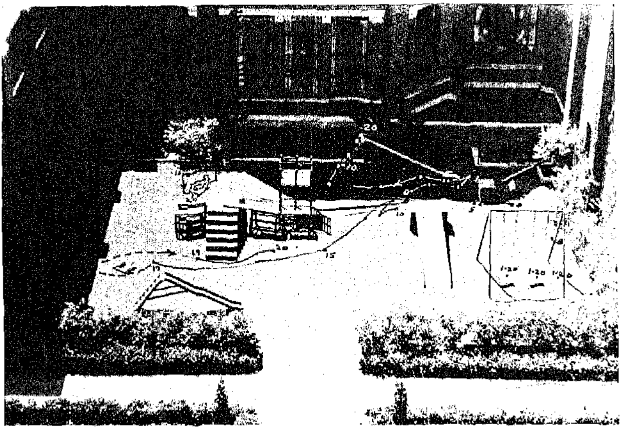
Analysis of Child Behavior by Intermittent Photography

CONTINUOUS recording with motion pictures is not only expensive but also frequently results in a larger quantity of material than is desirable or necessary for analytic purposes. Dr. Bruce Greenshields of Denison University, in researches at the University of Michigan, has evolved equipment in connection with a study of traffic, which permits the taking of pictures on sixteen-millimeter film at predetermined intervals. A Simplex motion picture camera capable of taking single frames is operated by a motor driven by an automobile storage battery. The time interval between exposures can be varied from one-half a second to two seconds by changing the voltage.



The applicability of the equipment to the investigation of the activities of children is being studied at the present time in connection with the child development research program of the University Elementary School of the University of Michigan. The camera was set up on the roof of the building and pointed downward at the *playground area. A record has been* made for one hour at the rate of one picture every two seconds for the activities of the five-year-old group on a court playground. Some preliminary analysis of the material has been made with the assistance of student help under the Federal Emergency Relief Act. The general procedure consists in projecting a picture of the playground site and tracing it upon a sheet of white paper. The outline picture is redrawn with duplicator ink and a supply of copies obtained. Successive pictures are then projected and a trace of the path of each child is made with a colored pencil. One minute of film record suffices to cover a sheet to the point of confusion with the orbits of half a dozen active youngsters. The illustra*tion gives the activity of six children* in each of 20 two-second intervals. Three paths are shown with dots at the intervals. Three children remained in their general location at the swing. Since the pictures were taken at some distance, positive identification of the children was facilitated by the use of telephoto pictures as a supplement.

The type of record keeping described should be an aid in the study of the interest value of materials and equipment, the amount and character of physical activity of children, analysis of social behavior, and the significance of the several types of data in terms of other determinable characteristics for the children involved.

Roy S. Swinton.

The Influence of Size of Kindergarten Group upon Performance[1]

HELEN C. DAWE

THE relative merit of large and small classes and of the various seating positions within the group has been of considerable interest to teachers and workers in the field of education and psychology, but investigations of the problem have been confined to the elementary grades and to classes at high school and college level. The present study aims to determine the effect, at kindergarten level, of the size of the group and of the child's position in that group upon the amount learned and upon the contributions made to group discussion.

The earlier studies (as summarized by Hudelson (4)) are not, of course, in complete agreement, but the majority find: that there are no differences between large and small classes in terms of student accomplishment, that large classes do not penalize the student and that, in some instances, students in large classes surpass those in smaller ones.

Studies of the effect of seating position (1, 2) on student grades agree that students in the front center of the room receive higher grades than those at the sides and rear.

The results of such investigations are suggestive but the conclusions derived from them can not be applied directly to the kindergarten situation, for in the first place the criterion as to what constitutes a large or a small group varies considerably from one study to another, (a "small" university class is often larger than a "large" kindergarten group) and furthermore the subjects chosen are pupils in the elementary and upper grades where the learning situation is a more strictly formal one.

The first part of the present study was concerned with the amount which kindergarten children retained from a single reading of a new story; the second part was concerned with the degree to which the children entered into a discussion of material presented to them for the first time. Both parts of the study were carried out in all the schools in which we worked.

For the first part of the study, the material used was a modified translation of "La Gironata de Titi," 992 words in length with 13 illustrations. The kindergarten teacher read the story to the group of children without comments or explanations except in so far as it was necessary to answer the children's questions. Such questions, however, were very rare. After reading each page of text, the teacher displayed the illustration accompanying that page.

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[1] From the Institute of Child Welfare, University of Minnesota. The writer wishes to thank Dr. Josephine C. Foster for her many valuable suggestions and the teachers of the cooperating kindergartens for their generous assistance which made this study possible.

The subjects used were 433 kindergarten children in nine Minneapolis public schools. Of the children, 190 attended the afternoon session (first semester) and 243 the morning session (second semester of kindergarten). The groups ranged in size from fifteen to forty-six children.

On a seating chart the observer recorded the position of each child. Row 1 contained those children who were next to the teacher, row 2 those who had one child between them and the teacher, etc. "Center" included the three vertical rows of children directly in front of the teacher. "Right" included those sitting outside of this section at the teacher's right; "Left" those at the teacher's left.

TABLE 1

Mean score on story for boys and for girls, AM and PM

	BOYS		GIRLS		BOTH SEXES	
	Mean score	Number of cases	Mean score	Number of cases	Mean score	Number of cases
AM group	12,24	126	12.25	117	12.37	243
PM group	11.25	91	11.69	99	11.48	190
Both AM and PM	11,82	217	12.14	216	11.98	433

On the day following the reading of the story each child was questioned individually by the observer. In this examination the story was retold very briefly to the child with 7 questions on different episodes interrupting the continuity of the story. Colored paper dolls representing the characters in the story were shown to the child at this time to heighten interest. A correct answer was recognized with a "Yes, that's right" or "That's just what happened;" an incorrect answer was ignored unless it affected the rest of the story in which case the observer said "No, it wasn't quite that way" and then gave the correct version.

The child's score was computed by giving 2 credits for each correct answer, 1 credit for each partially correct answer and deducting 1 credit for each wrong answer. The possible range for total scores under this plan was from −7 to 14, but to avoid the use of negative scores 7 was added to each score, thus making the possible range from 0 to 21.

The scores which the children actually received range from one to twenty-one with an average score of 11.98 ±3.84. The average scores for boys and girls and for morning and afternoon children are presented in table 1. In all instances the scores for the afternoon children fall slightly below those of the morning children. Although sex differences are practically negligible, the girls receive slightly higher scores. Figures 1a and 1b represent the frequency distribution of the scores for morning and afternoon, and for boys and girls. In general the scores fall into a normal curve of distribution.

Figure 2 shows the distribution of

average scores by size of group. Differences between the groups are small but there is an indication that the middle size groups have the higher scores. A rank order correlation of .37 shows that there is a slight positive relationship between average score and size of group. However, since there are more small groups in the afternoon than in the morning and since the afternoon children receive lower scores, the correlation is unduly weighted by the low afternoon scores. When size of group and average score are correlated for the morning groups the correlation drops to .10. The finding, then, of such a slight positive relation justifies only the conclusion that, in agreement with the majority of studies reported in the literature, large classes do not penalize the scores of the members.

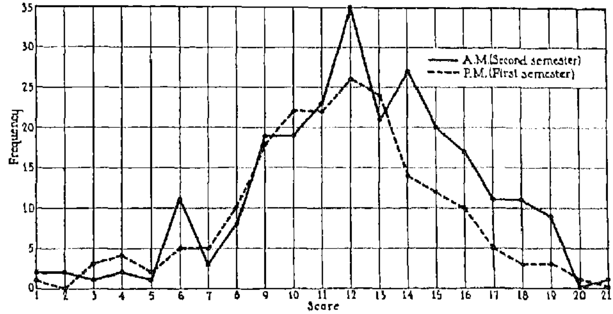

FIG. 1a. SCORES OBTAINED ON RECALL OF A STORY BY MORNING AND AFTERNOON SESSION

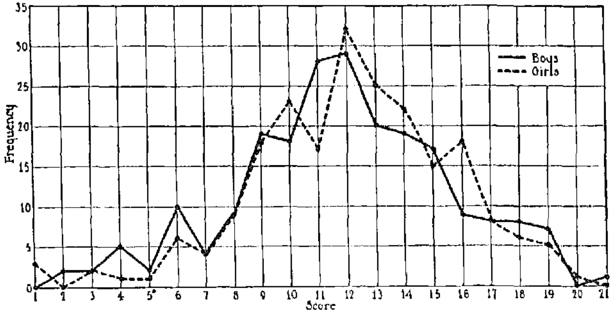

FIG. 1b. SCORES OBTAINED ON RECALL OF A STORY BY BOYS AND GIRLS

When the average scores are computed for the various positions within the group the differences by row (shown in table 2) are again inconsistent and negligible; although the scores for the center position are slightly higher than those for left or right in both the morning and afternoon, the scores overlap considerably and the differences are so slight that no one position can justifiably be considered superior to the others.

To exclude a possibility that the greater number of small schools might be concealing a possible real difference between the extreme positions, the first two rows and the last two rows in the two largest schools were compared. In these schools 29 children sat in the front rows in the morning, 30 in the afternoon; 27 sat in the back rows in the morning, 30 in the afternoon. The

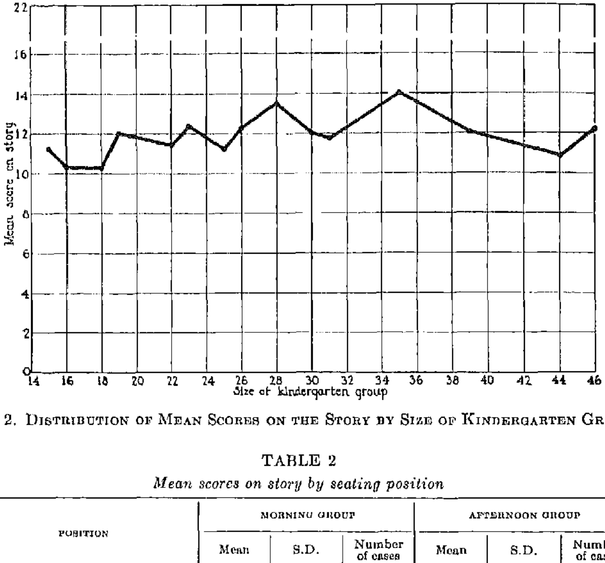

FIG. 2. DISTRIBUTION OF MEAN SCORES ON THE STORY BY SIZE OF KINDERGARTEN GROUP

TABLE 2

Mean scores on story by seating position

POSITION	MORNING GROUP			AFTERNOON GROUP		
	Mean	S.D.	Number of cases	Mean	S.D.	Number of cases
Row 1	12.74	3.02	53	11.14	3.78	50
Row 2	12.44	3.21	68	11.52	3.30	58
Row 3	12.26	4.25	65	11.79	2.95	42
Row 4	12.38	3.66	42	11.20	3.32	25
Row 5	11.27	3.45	15	12.07	3.46	15
Left Rows	12.23	4.09	83	11.31	3.14	52
Center Rows	12.49	3.23	106	11.65	3.59	83
Right Rows	12.37	4.05	54	11.38	3.32	55

average scores are slightly higher for the back two rows in the afternoon sessions (11.43 as compared with 10.86) while in the morning this relation is reversed (12.72 as compared with 12.48).

Certainly all the data warrant the conclusion that size of group may have a slight positive effect, while position in the group has no demonstrably consistent effect upon the amount of information the children retain after hearing a story read to the group. We may conclude that large and small groups offer an equal opportunity to learn this type of material and that individual differences in score are not affected to any great degree by the child's seating position. This finding agrees in general with studies of class size as reported in the literature, although these studies are concerned with a more formal type of learning and instruction and with older children, for the majority find either that class size has no appreciable consistent effect on learning or that children in large classes learn equally as well as those in smaller ones.

For the study of the effect of size of group and position within the group upon participation in discussion, we used a large brightly painted Noah's Ark containing eight pairs of animals three inches in height—elephant, cow, horse, pig, goat, bear, giraffe, and camel.

The teacher conducted a group discussion, stimulating conversation from the children by questions chosen from several possible leads suggested by us or by questions of her own. During the first ten minutes of the discussion the observer kept a record of the number of remarks contributed by each child. One word answers made in chorus were not recorded.

The subjects were 460 children in 17 groups ranging in size from fourteen to forty-six. Two hundred and three of the children were attending the first semester of kindergarten; 257, the second.

The average number of remarks per child for boys and girls, and for morning and afternoon children are given in table 3. Differences between morning and afternoon children are very slight and are not consistent. Interestingly enough the boys contribute more remarks than the girls.[2] This difference is more pronounced when the percentage of total number of remarks is computed. Table 3 also shows that the girls are more often silent than the boys. Whether this means that kindergarten boys are in general more talkative than are girls or that the material which we were using was more interesting to the boys, is not clear.

The differences in the average number of remarks per child according to size of group are presented in figure 3. Here there is a definite difference in favor of the smaller groups, for the smaller the group, the more remarks each child contributes. In a group of 14, for instance, the average number of remarks per child is 6.71, while in a group of 45 the average is only 1.20.

It is obvious that in a period limited

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[2] Hall (3) in 1891, gave information tests to 200 five and six year old children. The boys excelled in knowledge of animals. Hall also reported that Hartmann, testing 1312 children from $5\frac{1}{4}$ to $6\frac{3}{4}$ years found that boys excelled in concepts referring to animals.

Probst (5) testing 100 children from 5.4 to 6 years found boys superior to girls in concepts of animals.

to 10 minutes the more children there are in the group the less opportunity there is for each child to contribute. Accordingly, as the group grows larger one or the other or both of two conditions may occur. Either a smaller percentage of the children in the group will have a chance to contribute within the time allowed; or, the total number of remarks will fail to increase proportionately to the increase in the number of children in the group simply because there is a limit to the total number of remarks that can possibly be made within a definite time, and when this occurs, of course, the average number of remarks per child will decrease as the size of the group increases.

The results of this study show both these factors operating: the larger the group the greater is the number of children talking (rank order correlation between number talking and size of group is .82), but the percentage of children who contribute lags behind the increase in size of group considerably (rank order correlation between percentage of children talking and size of group is −.58); at the same time the total number of remarks does not increase in proportion to the increase in size of group (rank order correlation between total number of remarks and

TABLE 3

Responses in discussion group

	MEAN NUMBER OF REMARKS		PER CENT OF TOTAL REMARKS MADE		PER CENT OF CHILDREN SAYING NOTHING		NUMBER OF CASES	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
AM	3.57	2.22	61.7	38.3	32.6	41.4	129	128
PM	3.25	2.71	52.3	47.7	36.1	37.7	97	106
Both AM and PM	2.90	2.97	57.5	42.4	34.1	39.7	226	234

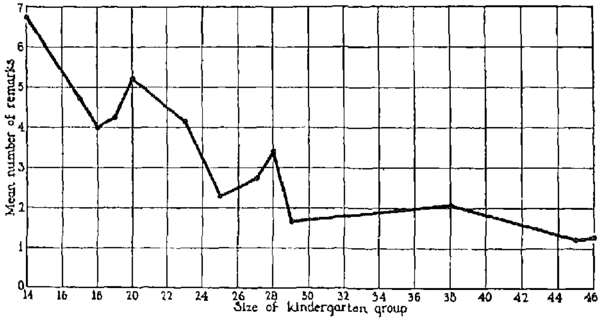

Fig. 3. Mean Number of Remarks per Child by Size of Kindergarten Group

size of group is −.14), and the average number of remarks per child in larger groups is too small to be accounted for entirely by the fact that the time limit for all groups was the same.

TABLE 4

Average number of remarks per child for each seating position

	AM			PM		
	Mean	S.D.	Number of cases	Mean	S.D.	Number of cases
Row 1	4.12	5.19	78	5.28	6.66	56
Row 2	3.06	4.03	70	2.44	2.92	61
Row 3	2.34	2.83	56	1.85	2.83	46
Row 4	1.60	3.50	40	1.42	1.65	26
Row 5	1.15	2.21	13	.36	.48	14
Left Rows	2.64	3.77	88	3.43	4.57	63
Center Rows	2.77	3.86	93	3.48	5.37	76
Right Rows	3.36	4.88	76	1.89	2.76	64

It must be borne in mind, of course, that the larger groups might not be penalized so greatly if the time during which records were taken had been increased, but the finding is, in effect, a practical one since not all can be given an opportunity to participate unless the discussion be so prolonged that it becomes fatiguing; as a matter of fact the usual discussion periods in the kindergarten program seldom last more than 15 minutes.

TABLE 5

Percentage of total remarks made in each seating position

(weighted for number of children in each row)

POSITION	PERCENTAGE OF TOTAL REMARKS	
	Morning	Afternoon
Row 1	34.2	49.4
Row 2	25.1	20.5
Row 3	18.1	15.3
Row 4	13.0	11.7
Row 5	9.6	3.0
Left Rows	30.2	38.8
Center Rows	31.6	39.5
Right Rows	38.1	21.5

TABLE 6

Percentage of children saying nothing in in each seating position

POSITION	PERCENTAGE SAYING NOTHING	
	Morning Group	Afternoon Group
Row 1	26.9	21.4
Row 2	37.1	32.8
Row 3	32.1	52.2
Row 4	52.5	38.5
Row 5	69.2	64.3
Left Rows	37.5	34.9
Center Rows	36.6	38.2
Right Rows	36.8	37.5

Many of the kindergarten teachers reported they usually found it more difficult to elicit conversation from a small group. In a larger group the remarks of the other children stimulate conversation, while in a small group the teacher has to stimulate a greater share of the conversation herself. Our results, however, show that there is a slight tendency for a greater amount of discussion in the smaller group. It may be more difficult to initiate the discussion, but once started the children in a small group, at least in so far as a discussion of this type is concerned, talk more than those in a large group.

When the results are tabulated by the child's position in the group, we find a consistent tendency (though there is overlapping) for the number of remarks to decrease the further the child is seated away from the teacher (table 4). When the number of remarks made in each row is expressed as a percentage of the total number made in the group (table 5) (allowance made for varying number of cases) we see that over a third of the remarks are made by children sitting in the first row, while those in the last row contribute a tenth or less. When the data are tabulated according to the number of children who make no contribution at all to the discussion, the same tendency is apparent (table 6). Thus, 69.2 per cent of the children in the last row are silent, whereas only 26.9 of the children in the first row say nothing. The corresponding figures for the afternoon children are 64.3 and 21.4.

The differences between left, center and right are inconsistent and so slight that the only conclusion justified is that, under our conditions at least no one position is more advantageous than another.

TABLE 7

Changes in seating positions on successive days

	DISTRIBUTION OF CHILDREN ON THE TWO DAYS				
	Row 1	Row 2	Row 3	Row 4	Row 5
Story-day	24.8%	29.4%	24.3%	12.6%	6.3%
Discussion-day	30.6	28.9	21.6	11.6	4.6

	PERCENTAGE SHIFTING THEIR POSITION ON THE SECOND DAY				
	No rows	1 row	2 rows	3 rows	4 rows
Morning group	24.5%	42.2%	24.5%	6.0%	2.5%
Afternoon group	29.0	41.9	22.3	5.5	1.1

It is possible that the talkative child tends to sit in front while the reticent, less assertive child chooses or is content with a seat in the rear of the group. Our records of seating position on two different days show that more children sat in the front row for discussion than for the story, suggesting that when certain children realize that new material is to be shown, they move nearer the front. The percentages of children sitting in different rows for the story and for the discussion are presented in table 7. Generally speaking, however, the children's positions are relatively stable with an average shift of not more than one row. The average change in position and the percentage of children shifting according to number of rows moved are given in table 7.

In summary, we may say that increase in size of group in the kindergarten (at least between the limits of *fourteen and forty-six*) *does not reduce* the amount of a story which was retained by the children, but that increase in the size of the group means a cutting down in the percentage of children who take part in a discussion, in the total amount of discussion and in the average number of remarks per child. Position in the group apparently does not influence the amount of a story, which these kindergarten children retain but does affect the extent to which they enter into a discussion.

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A Tentative Report of the Influence of Nursery School Training upon Kindergarten Adjustment as Reported by Kindergarten Teachers[1]

HAZEL M. CUSHING

THE attempt to justify education in the nursery school by demonstrable quantitative evidence is attended by the same difficulties as is similar proof of the existence of permanent values inherent in education at any other level. Educationists produce triumphantly the achievement or educational test as evidence that educative process lends itself to the test of scientific measurability. This, in spite of the obvious shortcomings of such a type of measurement, namely (1) that much of the factual knowledge so measured is for all practical purposes lost in succeeding years, (2) that the value of such facts as are inculcated in relation to the subsequent problem of living has never been quantitatively gauged, (3) that even if later value to the individual should yield to indubitable proof, more economical learning processes might be substituted for the long drawn out, expensive, and frequently painful road adopted by the formal educationists, and finally (4) that of the half dozen or more objectives set up as educational goals, and presumably of approximately equal importance, the achievement test measures but one, namely, intellectual acquisition. Growth in social adaptability, emotional control, inner poise and serenity of spirit, ability to deal with new situations, to solve the complex problems of living, health, initiative, as well as the factors that go into the elusive item termed 'good citizenship,' all rest obscurely up to date in the limbo of speculation.

Despite such obvious limitations in attempts to measure the results of the schooling process in general, nursery school proponents must, nevertheless, join other educators in an attempt to test educational values accruing from a specific type of training. Only thus can education at the nursery school level justify its membership in the educational family as well as defend itself against all too glibly-hurled charges of faddism.

There have been few attempts to measure the effects of nursery school training. In the studies reported it

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[1] Acknowledgment is made to the members of the child development staff, Miss Harriet Stillman, Assistant Director of Elementary Grades and Kindergartens, and the various kindergarten teachers who rated the subjects, Dr. Ruth Hubbard and to Miss Olive Young, who tabulated the material.

has been the traditional or mental values of training which have been most frequently investigated—not, to be sure, in the sense of educational tests of formal subject matter which has no place in the preschool curriculum, but in relation to the quantitative and qualitative changes in mental capacity.

Goodenough, Barrett and Koch, Woolley, Updegraff, Wellman, Kawin and Hoefer[2] have reported investigations of this type. Although the evidence is somewhat conflicting, the net result to date yields no support of the theory that nursery training *per se* affects permanent changes in the mental status of the recipients of such training.

As to the effect of nursery school training upon health and personality, there is even less available material, due, no doubt to the difficulties of isolating such intangibles and to the lack of suitable standardized measuring instruments.

Comparing 470 records of nursery school children from two to six years of age with reports from three control groups, Updegraff (6) came to the conclusion that the nursery school which furnishes adequate daily health inspection reduces the incidence of communicable diseases. In other words, that "a school group so conducted is a more favorable environment to prevent contagion than the home ordinarily is." The specific diseases studied were chicken pox, measles, mumps, scarlet fever, and whooping cough.

Campbell (2) studied the food habits of 33 children enrolled in the Merrill-Palmer Camp, 18 of whom had had nursery school training. The children ranged in age from 6 years to 13 years and 5 months. A Food Habits Rating Scale was devised in accordance with Thurstone's procedures. There appeared to be little difference in the food habits of the two groups. There was some evidence that the nursery school group ate more milk and vegetables. There was also some indication that the children who had attended nursery school most recently evidenced the better food habits. Food habits of siblings were more strikingly alike even when one of a pair had attended nursery school, than were resemblances between nursery school children in general. Hence the conclusion is that the home is a much more important factor than the nursery school in forming food habits and attitudes.

Walsh (7), using the Bonham-Sargent Scale, tested a group of 22 nursery school children over a period of 6 months. Compared with a similar group of controls, the experimental group became less inhibited, more spontaneous and more socialized with training. They developed greater initiative, independence, self-assertion, self reliance, showed a greater increase of curiosity and interest in their environment, and developed superior habits of health and order.

Taylor and Frank (5) of the Illinois Institute for Juvenile Research investigated follow-up techniques for former nursery school children employed in nineteen centers. They reported that in 1931 only 2 institutions, the University of California and the University of Minnesota, appeared to have developed a well-defined plan of follow-up. They also gave a preliminary report of their own follow-up study of 38 children who have been in nursery school at least one year. At the time of re-examination most of the children were more than six years of age—a few had gone as far as the third grade. The follow-up consisted of physical and psychological retests, and ratings by mothers and teachers. These investigators felt that difficulties encountered and the small number of cases did not warrant any valid conclusions. Personality difficulties such as temper tantrums and negativism noted as of frequent occurrence by the nursery school teacher appeared rarely to be present in the elementary school. They suggest as a possible explanation either that a large group and the impersonality of the teacher's attitude tends to discourage such displays, or that due to pressure of work, the teacher is less likely to observe such phenomena.

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[2] See appended references.

The preliminary study herein reported concerns the adjustment of nursery school children to the kindergarten situation as estimated by kindergarten teachers. Frequent fears have been voiced by kindergarten teachers and also by parents to the effect that children experiencing nursery school might be 'spoiled' for kindergarten, that they would be more or less blasé because of the similarity of materials presented at both levels, that the greater freedom granted in the nursery school environment would militate against coöperative behavior in the more restricted and directed atmosphere of the kindergarten, that parents would be less satisfied with the kindergarten régime, that they would tend to expect much more personal consideration for themselves and their children than is possible for the kindergarten teacher to grant in view of the large number of children committed to her care.

The subjects. Over a period covering approximately two years it was possible to get teacher ratings on 33 children, 10 boys and 23 girls, who had received training in a demonstration nursery school in session from 8:30 a.m. to 3:00 p.m. The average nursery school attendance for the group as a whole was 172 days, the range from 81 to 326 days. Intelligence quotients based upon the Kuhlman-Binet Test[3] ranged from 93 to 150 with the mean at 120.

Practically all of the families involved ranked in the upper 50 per cent of the population in respect to socio-economic status. In general, the children upon leaving nursery school attended public schools in the better residential sections of the city. Hence the assumption is made that they were received into kindergarten groups of fairly similar social status.

There were, however, two observable discrepancies between the nursery school and the non-nursery trained kindergarten children. The former averaged four months younger than the latter in respect to C.A., the mean ages being 55 months and 59 months, respectively. The difference is statistically significant.

As has been stated above, the average intelligence quotient for the nursery school group was 120. Composite ratings based upon intelligence tests and teachers' estimates, general adjustment and maturity were available in the case of ten nursery school children who had passed into the first grade. In eight cases, the nursery school children ranked in the upper quarter; in two, in the upper half of the second quarter. It is thus apparent that with respect to intelligence the nursery school group as a whole probably ranked above the average of the kindergarten groups in which they were placed. Reference will be made to this point later in connection with the 'control' group.

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[3] In all but two instances.

The raters. Adjustment ratings were made by nine different teachers. Nineteen children, however, were rated by 2 teachers only, 3 teachers rated but one child so that the scatter in respect to raters is not large as would appear at first glance. Each teacher was asked to rate the nursery school child from not less than three to more than six weeks after his entrance to kindergarten and to send the blank immediately to the Child Development office. Without reference to her first rating, she was then asked to rate the child a second time at the close of the semester. Samples of typical behavior responses were grouped under the headings *Health Habits*, *Social Adaptability*, *Use of Environment*, and *Personality Traits*. The teacher was asked to check each one of these responses in two ways, first, as to the frequency of its occurrence, in terms of *always*, *usually*, *frequently*, *seldom*, or *never*, and second, as to whether the behavior noted was *poorer than*, *better than*, or *average* with reference to the typical behavior of the group as a whole.

In addition the teacher was asked to check the item most descriptive of the child's response to the kindergarten environment as follows: *enthusiastic*, *interested*, *indifferent*, *bored*, *rebellious*. She was also required to evaluate the child's adjustment on the whole, whether *better*, *poorer* or *average* as compared with that of the group. She also listed kindergarten activities which the nursery school child appeared to enjoy most and the materials he used most frequently and with greatest interest. She was asked to report as to whether the mother expected an undue share of attention for the child.

The complete progress blank[4] is given on pages 312 to 314.

Twenty-seven cases were rated both at the beginning and at the end of the semester, 4 were rated at the beginning only and 2 at the end only.

Table 1 gives the percentages of occurrence for both the first and second ratings, together with results on a control group of 25 kindergarten children to be referred to later. In translating the items listed under *personality traits* in terms of desirability, it must be borne in mind that the less frequent the occurrence, the more favorable the behavior. The opposite is the case in the three other categories, health habits, social adaptability, and use of environment, where a high frequency of the behavior items indicates desirable responses.

Differences between first and second ratings are noticeably small. This would seem to argue either for a

[4] Items were taken in part from records used at Merrill-Palmer School, University of Minnesota and the article by Taylor and Frank referred to above.

certain reliability in the ratings or to indicate that teachers have a certain generalized attitude toward children in the kindergarten in which the nursery school child shares. There is, however, a small but consistent trend toward a better rating on the second blank in all of the four categories. This may indicate (1) that the teacher has through a longer acquaintance had more opportunity to observe the child's responses, (2) that real learning has taken place during the semester, or (3) that the child has become somewhat more of a conformist, owing to the social pressure put upon him in the new environment.

Table 2 indicates the extent to which the behavior of the nursery school children accords with that of the group. Results for the control group are also given for the sake of convenience. Less than 20 per cent of the ratings are below the average adjustment. Approximately 10 per cent fall in the high group, the majority of ratings lie in the average group.

The general ratings which indicate the teacher's impression of the child as a whole given in table 3, substantiate the itemized ratings except that more nursery school children are rated better than average, the per cent being approximately 20, as against 10 per cent indicated in table 2. These figures may indicate the tendency of raters to avoid extremes. In any case, however, they do not seem to warrant the assumption that the nursery school child adjusts with great difficulty to the demands put upon him by the kindergarten environment.

It was possible to check in a

TABLE 1

Frequency of occurrence ratings in terms of percentage

	ALWAYS	USUALLY	FRE-QUENTLY	SELDOM	NEVER	NOT RE-PORTED
Health habits:						
Rating I	27	39	11	13	1	9
Rating II	37	29	13	7	2	12
Control	49	24	6	6	2	13
Social adaptability:						
Rating I	38	26	19	10	4	3
Rating II	38	32	18	8	3	1
Control	51	22	12	9	4	2
Use of environment:						
Rating I	31	26	12	19	10	2
Rating II	42	27	15	13	3	0
Control	43	22	11	16	8	0
Personality traits:						
Rating I	1	2	7	10	60	20
Rating II	1	2	12	16	51	18
Control	1	1	4	8	74	12

measure the validity of the general ratings. Each child was rated separately on a five point scale by the two nursery school teachers who knew him best in respect to his general adjustment to the nursery school situation. Intercorrelation between these two pairs of ratings were .903 ±.03 and .74 ±.07 respectively. The average ratings were then correlated against the total adjustment ratings of the kindergarten teachers. There was a fair degree of agreement (r = .37 ±.10) between the kindergarten teachers' general estimate of the child and that of the nursery school teachers.

TABLE 2

Comparison of behavior of nursery school children with kindergarten group as a whole in respect to the four categories in terms of percentages

	LOWER	AVERAGE	HIGHER	NOT REPORTED
Health habits:				
Rating I	5	74	11	10
Rating II	7	72	7	14
Control	9	71	7	13
Social adaptability:				
Rating I	19	66	12	3
Rating II	19	70	11	0
Control	18	63	17	2
Use of environment:				
Rating I	26	64	7	3
Rating II	18	69	13	0
Control	29	59	11	1
Personality traits:				
Rating I	8	55	11	26
Rating II	1	57	16	26
Control	0	78	10	12

TABLE 3

Comparative adjustment ratings in terms of percentages

	BETTER	AVERAGE	POORER	NOT REPORTED
Rating I	26	52	22	0
Rating II	21	62	14	3
Control	28	44	28	0

No nursery school child was rated as bored or rebellious in his attitude toward the kindergarten either during the initial period or at the end of the semester. Practically all were rated as 'enthusiastic' or 'interested.' Table 4 presents these ratings in terms of percentages.

Ten per cent only of mothers were found to be inconsiderate in their demands upon the teacher's time.

In order to check further the validity of the ratings the same teachers were asked to rate approximately the same number of non-nursery school children. They were asked to pick the younger children in the group in order to equalize the factor of age as nearly as possible. For administrative reasons ratings had to be secured before the end of the semester. It was possible to secure only one rating for this group. This was not considered a serious handicap, however, since the earlier part of the study indicated considerable conformity between first and second ratings. Twenty-five cases, 10 boys and 15 girls, comprise the control group. Attendance in kindergarten for this group averaged 27 days.

TABLE 4

Response to kindergarten situation in terms of percentages

	ENTHUSIASTIC	INTERESTED	INDIFFERENT	BORED	REBELLIOUS
Rating I	42	55	3	0	0
Rating II	59	41	0	0	0
Control	40	44	16	0	0

TABLE 5

	DAYS OF ATTENDANCE		CHRONOLOGICAL AGE		INTELLIGENCE QUOTIENT	
	Range	Mean	Range	Mean	Range	Mean
Nursery group rating 1	9–36	20.7	45–64	55.4	93–150	120
Nursery group rating 2	50–88	71.7	55–66	59.6	93–150	120
Non-nursery control	16–35	27.3	58–60	59.5	75–129	107.3

Table 5 shows in comparison number of days of attendance, the chronological ages and intelligence quotients of the two groups.

A comparison of ratings indicates a slight superiority for the control group in Health Habits, Social Adaptability, and Personality Traits. In Use of Environment nursery school children excel slightly on the second rating. Refer to table 2. When the teacher rates the behavior as low, average, or high in comparison with that of the group, however, the situation is reversed and the nursery school group maintains a slight superiority in all categories. (Refer to table 3.)

The attitude of the non-nursery mothers shows that 12 per cent expect the child to receive an undue share of the teacher's attention as compared with 10 per cent of the nursery school mothers.

Few differences appeared between the two groups in regard to the use of materials or choice of activities. Blocks, crayons, paper, paste, plasticine, scissors and sewing appeared popular with both groups. It is significant, however, that both in regard to the amount of material used and total number of activities

TABLE 6

	RATING I	RATING II	CONTROL
Number of materials listed	69	67	54
Number of activities listed	55	56	33

listed the nursery school exceeded the control group considerably. Total number of choices is indicated in table 6.

Summary. In this preliminary study of the adjustment of nursery school children to kindergarten there would seem to be no evidence that the nursery school trained child makes an inferior adjustment to kindergarten, despite his handicap in chronological age. The 33 children rated were about 4 months younger on the average than the kindergarten group with which they were placed. Although intelligence quotients were not available for the kindergarten group as a whole, it is probable that the nursery school group were superior in this respect, since only two children out of ten ranked in the normal group, the rest having intelligence quotients above 110.

When compared with a group of non-nursery kindergarten children of similar chronological age, no striking differences were observed. The nursery school group, however, did appear to be rated somewhat superior in their total adjustment to the situation and considerably more so in general attitude.

Mothers of nursery school children do not appear to be more demanding of kindergarten teachers than mothers of non-nursery trained children.

Derogatory remarks concerning the adjustment of nursery school children to kindergarten on the part of kindergarten teachers may frequently emanate from experiences with isolated cases to which any of the following factors may be contributory:

1. The lower chronological age of the nursery school child combined frequently *with high intelligence*—such a child tends to present a problem in a conventional school group at any level.
2. The freedom and lack of restriction in the nursery school which may run counter in some instances to the greater conformity demanded in the kindergarten.
3. The use of initiative stressed in nursery school as against passive participation in the more directed types of activity of the kindergarten.
4. The fact that it is highly probable that a selective behavior factor influences enrollment in the nursery schools, that is, a higher proportion of 'difficult' children probably find their way to nursery schools as they are set up at present.
5. A certain antagonism and distrust of the nursery school on the part of the kindergarten teacher, so that she may unconsciously be more highly critical of the nursery trained child.
6. The fact that the term 'nursery school' is used at present to convey a variety of situations and a varied length of training. There is a current tendency to loosely characterize any child who has ever attended any sort of preschool group for any length of time as a 'nursery school' child.

Certainly much research is needed before facts can be stated with any degree of finality in regard to the effect of nursery school training upon the subsequent progress and adjustment of the child.

PROGRESS BLANK

CHILD DEVELOPMENT AND PARENT EDUCATION

ROCHESTER, NEW YORK

Date........................

Child's name..

Address..

Father's name.............................Mother's name..............................

Nursery school...

Address of nursery school..

Attended from....................................to....................................
(date and year) (date and year)

Total attendance in nursery school.................days. Public school number........

Total attendance in kindergarten...................days. Age entered kdgtn............

Kindergarten teacher...

Go through the questionnaire and check Column I.

Then go through it a second time and check Column II.

Method of Scoring

Column I

A—child *always* expresses behavior.
U—child *usually* expresses behavior.
F—child *frequently* expresses behavior.
S—child *seldom* expresses behavior.
N—child *never* expresses behavior.

Column II

L—child exhibits behavior in *less* degree than average of group.
A—child exhibits behavior corresponding to *average* of group.
H—child exhibits behavior in *higher* degree than group.

Check all items somewhere on the scale but put a question mark (?) after judgments of which you are not sure.

	Column I					*Column II*		
HEALTH HABITS	*A*	*U*	*F*	*S*	*N*	*L*	*A*	*H*
Uses handkerchief when needed	—	—	—	—	—	—	—	—
Protects others when sneezing or coughing	—	—	—	—	—	—	—	—
Attends to toilet needs independently	—	—	—	—	—	—	—	—
Washes hands after toilet	—	—	—	—	—	—	—	—
Washes hands before handling food	—	—	—	—	—	—	—	—
Refrains from putting objects to mouth	—	—	—	—	—	—	—	—
SOCIAL ADAPTABILITY—EMOTIONAL BEHAVIOR								
Seeks companionship with other children	—	—	—	—	—	—	—	—
Coöperates in group projects	—	—	—	—	—	—	—	—
Gives creative suggestions in group activities	—	—	—	—	—	—	—	—
Respects rights of others	—	—	—	—	—	—	—	—
Is kind and helpful to others	—	—	—	—	—	—	—	—
Adjusts readily to new situations	—	—	—	—	—	—	—	—

Shows a reasonable degree of self control in conflict with others........ — — — — —   — — —
Appears happy and content in school environment........ — — — — —   — — —
Is willing to accept authority when occasion demands........ — — — — —   — — —
Is satisfied with normal amount of attention from teacher........ — — — — —   — — —
Refrains from seeking undue attention from children........ — — — — —   — — —
Exhibits independence in putting on wraps........ — — — — —   — — —
Accepts correction in good spirit........ — — — — —   — — —
Is liked and included in group activities........ — — — — —   — — —
Shows a willingness to share........ — — — — —   — — —
Refrains from baby talk........ — — — — —   — — —
Is free from other speech difficulties........ — — — — —   — — —

USE OF ENVIRONMENT

Exhibits initiative in undirected activity........ — — — — —   — — —
Exhibits initiative in directed activity........ — — — — —   — — —
Has sustained attention until task is completed........ — — — — —   — — —
Shows curiosity and interest in surroundings........ — — — — —   — — —
Is creative with materials in environment........ — — — — —   — — —
Shows reliability in care of materials........ — — — — —   — — —
Displays ability to lead........ — — — — —   — — —
Displays ability to follow........ — — — — —   — — —
Runs with ease........ — — — — —   — — —
Skips with ease........ — — — — —   — — —
Hops with ease........ — — — — —   — — —
Handles tools and materials well........ — — — — —   — — —

PERSONALITY TRAITS

Check the degree to which the child shows the following behavior:

Crying........ — — — — —   — — —
Sulking........ — — — — —   — — —
Pouting........ — — — — —   — — —
Temper tantrums........ — — — — —   — — —
Negativism........ — — — — —   — — —
Fighting with other children........ — — — — —   — — —
Teasing........ — — — — —   — — —
Selfishness........ — — — — —   — — —
Whining........ — — — — —   — — —
Cruelty........ — — — — —   — — —
Tenseness........ — — — — —   — — —
Timidity........ — — — — —   — — —
Secretiveness........ — — — — —   — — —
Seclusiveness........ — — — — —   — — —
Distractibility........ — — — — —   — — —
Self-consciousness........ — — — — —   — — —
Attacking other children........ — — — — —   — — —
Destructiveness........ — — — — —   — — —
Day dreaming........ — — — — —   — — —
Emotional instability........ — — — — —   — — —
Enuresis (diurnal)........ — — — — —   — — —
Finger sucking........ — — — — —   — — —

Masturbation.............................. — — — — — — — —
Nail biting.............................. — — — — — — — —
Nose picking.............................. — — — — — — — —
Hyperactivity.............................. — — — — — — — —

List any other undesirable personality traits shown by the child:
....
Check the term which best describes the child's response to the kindergarten situation:
Enthusiastic........Interested........
Indifferent........Bored........Rebellious........

Kindergarten teacher's own evaluation of the nursery school child's adjustment:
On the whole:
(1) Does the child show a better or poorer adjustment to the kindergarten environment than the average kindergarten child?..............................
....
(2) What activities does the child appear to enjoy most?......................
....
(3) What materials does he use most frequently and with the greatest apparent interest?..
....
(4) Does the mother expect the child to receive more than his share of attention?...
....

Additional remarks:
....
....
....

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Children's Motor Learning With and Without Vision

Ruth Taylor Melcher

THE PROBLEM

WHETHER data from the visual processes or from tactual-motor manipulation are predominant in the acquisition and performance of skilled acts has been investigated by various methods with animal and adult human subjects, but there have been few attempts to study the relationship directly in the early stages of ontogenetic development. The specific problem of this experiment is the determination of the relative effectiveness of visual versus manual cues in the motor learning of young children.

Since motor learning ordinarily consists of a series of spatial coördinations, the ultimate problem involves the relative importance of visual and tactual-motor sentienda in the organization of our spatial perceptions. The question is whether stimuli from the visual processes (including all the kinesthetic sense data from eye-movements) are in themselves sufficient and initially dominant in producing spatial ideas and appropriate motor responses, or whether the sensory receptors in the responding organ itself must give the stimulus initially. In the latter case there are two alternatives: either these spatial coördinations, learned only through manipulation, guide and educate the visual perceptions, or the two systems are entirely independent originally, and become coördinated only through their association in use.

Prior to Berkeley, vision and touch (including movement) were held to be practically interchangeable sense modes. Berkeley (1) was the first to draw a sharp distinction between the reports of the two senses, and to contend that notions of space are not intrinsic to vision, but are built up through the movement and tactual experience of the individual. This theory directed attention to the experiences of those born blind, who later gained their sight through operation. This literature has been critically reviewed by von Senden (31), who came to the conclusion that the blind have no true spatial consciousness, but that this is bound up with visual perception. None of the observations on the blind were experimentally controlled.

The difficulty in arriving at any conclusion as to the origin of space habits in normal human adults obviously lies in the fact that they are already formed long before it is possible to bring them to the laboratory. To overcome this disadvantage, some investigators have attempted to break up the habits formed and observe new ones in formation through distortion of the visual world by means of prismatic lenses.

Stratton's (32) pioneer work with a monocular lens reinverting the retinal image led him to the conclusion that visual direction was not dependent upon tactual direction. Wooster (38), following Stratton's method, found that visual perception of the amount of error was the most helpful single factor in mastering a new space habit, and was as efficient as the tactual and kinesthetic factors combined in active touch. Ewert (11) agreed as to the primacy of visual receptors in spatially coördinated activity within the field of vision. He emphasized the typical motor learning curves of his subjects and contended that the process of reëducation after distortion of the visual field consisted simply in learning by trial and error to readjust motor behavior to new visual cues, rather than in any change in reference of the sensory data. Contrary to Wooster, however, he found that readjustment occurred where there were no overt localizing movements, although he admitted that gross adjusting movements might be replaced here by eye and head movements and by those involved in verbal activity. Finally he pointed out the influence of instruction and the ability of the human subject to inhibit sense data from receptors which might distract from the task in hand.

Recently Cutsforth (6) has demonstrated by an interesting technique the discrepancy between the visual and tactual-motor perception of spatial relationships, and the difficulties in translating tactual-motor sense data into visual terms.

Results obtained with rats have proved suggestive of problems involved in human learning. Watson (36) concluded, after extensive experiment, that the learning of rats in a maze was entirely dependent upon kinesthetic cues, each movement being the cue for the following one. Hunter (13, 14, 15, 16), Lashley and Ball (20), Dennis (8), Macfarlane (22), and Dorcus and Gray (10) have called in question the adequacy of this theory, although the rôle of vision was not specifically investigated. Perrin (23), one of the first to test blindfold human adults both with pencil and paper mazes and in an outdoor circular walking maze found that ability to run the maze developed with the ability to describe it verbally and graphically and concluded that human maze learning was perceptual and ideational rather than sensory.

Weaver and Stone (37) and Lindley (21) found that the performance of blind, anosmic, and blind-anosmic rats in a maze differed very little from that of seeing animals, but just after Watson had popularized the proprioceptive theory, Florence Richardson (30), working in his laboratory, found that blind animals were at a decided disadvantage in learning to solve certain problem box situations and to jump from one small platform to another. Subsequently Dennis (8) and Walton (34) showed that when the experimental arrangements in the maze were such that vision could be used to advantage, the animals depended predominantly upon visual cues.

All studies of the effect of vision in adult human maze learning have shown that visual aid greatly reduces errors, especially in the initial stages of learning. Brown (2, 3) whose subjects walked through a maze made by wooden troughs laid on the floor, found that persons allowed to see the ceiling and upper part of the doors and windows learned in fewer trials than those blindfold. His findings disagreed with Perrin's, however, in that the subjects were not able to draw or describe the maze after they had learned it.

The stylus maze has been the most frequently used instrument for the study of adult learning. Carr's (4) invention of the slot maze and his elaborate studies of the effect of visual guidance by this means all confirmed the effectiveness of visual aid in motor learning for adults. Carr and Osbourn (5) found that vision during the initial trials reduced both the errors and the trials, although errors more than trials. In three of four cases, the effect was even greater during the post-visual period than during the visual. Peterson and Allison (24) achieved results similar to Carr's when the visual exposure of the maze was measured by time instead of by number of trials.

Koch and Ufkess (19) found that seeing subjects were superior to blind subjects in learning a stylus maze. This was contrary to a priori opinion, since the situation seems analogous to the usual learning methods of the blind. Moreover, those who had once had sight did better than those who had been blind from birth, the intelligence level being, of course, the same. Contrary to these results, Knotts and Miles (18), comparing the maze learning ability of blind and seeing individuals from twelve to twenty-two years of age, found the blind superior by all criteria. Examination of the authors' graphs, however, shows that the differences were very small, and the more successful learners among the blind were those whose blindness was due to accident after five years of age.

Twitmyer (33) found that subjects who casually watched another person learn a maze, without expecting to learn it themselves, did better in the early stages of learning than the blindfold subjects, though a higher efficiency was attained in less time by the blindfold practice. Time was the only criterion of learning in this study, however, and error analysis might have given different results.

The preceding studies seem definitely to establish that the adult depends to a very great extent upon visual guidance in his ordinary motor learning. But the question remains whether this is the last stage of a development which began with dominance of tactual-kinesthetic cues. The assumption has often been made that children begin with dominance of kinesthesis in the responding organ and gradually shift to visual dominance, possibly substituting the kinesthesis of eye movements, at about puberty. Investigations of sensitivity to tactual stimulation in children and adults, both blind and seeing, by Renshaw, Wherry and Newlin (26, 27) and of primitive tribes by Rivers and McDougall (see 27) have been interpreted as substantiating this theory. Inspection of the data, however, throws some doubt upon these conclusions. De Sanctis' (9) maze experiment also indicated a shift, though at a somewhat earlier age.

Rice's work with young children is

in some respects the direct antecedent of the present study. Incidental to her investigation upon "The orientation of plane figures as a factor in their perception by children," (28) she found that success in reproducing a figure, whether from the model or from memory, was more closely related to perceptual development than to motor control. This the author cites as interesting "in view of the axiom derived from the response hypothesis that accuracy of motor response is a basis for accuracy of perception and later of thought." (28 p. 141) There is the possibility of the interpretation that perceptual development is responsible for the level of motor coördination.

Rice's third study (29) was an attempt to discover and analyze eye and hand movements occurring during an act of perception. Her subjects were 10 pairs of twins between 4.6 and 7.10 years of age. After a series of initial tests in which the child's eye and hand movements were recorded while he looked at a geometrical figure and his ability to reproduce it on a blackboard was tried, one of each set of twins was given a training course. Five children watched a bright yellow knob which traveled mechanically around a diamond shaped path on a black background. The other five children followed the knob with their hands but were not allowed to see it. There were nine ten-second trials in all, three at a time one day a week. Automatograph records of the hands were taken and the eye movements photographed on the first and last trial. The control group during this period only looked at the original card representing the diamond.

The author found "no transfer effect of any kind from imposed practice of eye and hand movements on eye and hand movements of an unrestrained nature used during observation of plane figures." The synchronized records of eye and hand movements showed no relation between them, either initially or after practice. There was a practice effect in the specific activity undertaken during the practice periods, i.e. the child learned to follow the moving knob. There was also "a possible transfer effect of this practice on the rather indefinitely defined activity of drawing the figure observed." (29, p. 47) Even the last mentioned positive results are questionable. However, the interesting point for the present study is that four of the instances of possible gain were from the five children subjected to eye training, while only two were from the five given hand training.

The results of this experiment, in conjunction with the previous finding that reproduction of a figure was related to perceptual rather than motor developmental level, suggest that visual data are dominant over those from other receptors in the education of eye-hand coördinations in the young child.

II. APPARATUS

Choice of apparatus for the experiment presented difficulties for several reasons. The problem required (1) that visual and manual cues be equated in manner of application, (2) that they might be given separately, and (3) that there should be a test of their relative effect.

Rice's (29) apparatus met the requirement of separate hand and eye training, but her method of testing by drawing the diamond introduced many new factors into the reproduction situation. As her own results showed, the ideal situation would be one in which the child was shown how to do a thing, and then asked to do exactly that thing. This ideal was not entirely realized, but a closer approach was attempted.

After some preliminary experimentation with maze patterns, a block design was selected. This was similar to Dasheill's (7) in his study of direction orientation in the rat in that it was a block pattern with no culs-de-sac other than the edges of the maze. Converted into a slot maze, similar to that designed by Carr (4) and popularized by Young (39) in the "Boy and Shoe" model, it furnished an instrument in which the child might watch a stylus travel a chosen path through the blocks, and then be asked to guide a similar stylus through the same path in an identical maze. Similarly, his hand could be guided through the path without accompanying vision, and the relative value of these two methods of guidance compared as to their effectiveness in the ability to reproduce the pattern. This study was not concerned with the relative value of guided and unguided learning, but only with the relative effectiveness of two methods of guidance.

A preliminary study with 15 children between the ages of three and five years showed that the task offered sufficient difficulty for differentiation.

While the "game" pleased most of the children at first, it soon became evident that some reward was necessary to insure continued effort. An animal cracker at the end of the test maze, concealed in a small box which opened when the child was successful, proved to be of lasting interest.

Figure 1 shows a surface view of the mazes. They were of hard wood, built up in layers. They were both 39 by 39 cm. square, with a solid border on a level with the top surface of 6 by 6 cm. blocks. The bases of the two were solid boards, 24 mm. thick.

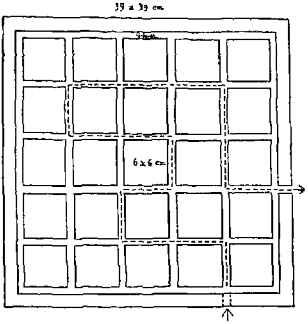


FIG. 1. SURFACE VIEW OF MAZE
The dotted line indicates the path traveled by the knob on the practice maze.

The practice maze had for its second layer two boards, 12 mm. thick, which were separated along their facing edges by 17 mm. This line of separation followed the dotted line shown in figure 1, forming the desired maze pattern. Similarly, two boards, 13 mm. thick, formed the third layer, separated along the pattern line by 9 mm. Thus the edges of this groove overhung those of the second layer 4 mm. on either side. In addition, grooves 6 mm. deep were cut in the top surface of these boards to form a block pattern. The top layer was of blocks 13 mm. thick, carefully fitted to the surface blocks of the third layer. When complete the pattern groove was 38 mm. deep, while the depth of the remaining grooves was 19 mm. The whole was painted a rich blue, and the lighting arranged from the side so that the grooves were in shadow and the difference in depth was indistinguishable to casual examination.

The floor and sides of the wide groove in the second layer were lined with sheet tin, and a Singer sewing machine belt 8 feet long was inserted, the ends projecting through holes in the maze side at the points indicated by arrows in figure 1. The corners against which the belt rubbed were rounded and brass rollers inserted.

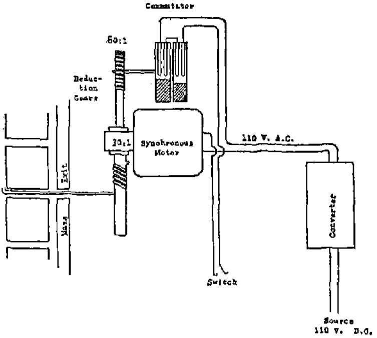


FIG. 2. DIAGRAM OF APPARATUS FOR PULLING THE STYLUS OF THE PRACTICE MAZE

A stylus 69 mm. high was attached to the belt, with brass disc roller guides, 11 mm. in diameter, above and below the point of insertion. The knob of light yellowish composition was 12 mm. in diameter, 24 mm. high, and extended 31 mm. above the surface of the practice board.

In starting position, the knob stood at the edge of the board in the groove indicated by the arrow in figure 1. The end of the belt extending through the exit was hooked to a shaft revolved, through a reduction gear, by a synchronous motor, and as the belt was wound the attached knob traveled the indicated path, requiring 17 seconds to reach the exit. The mechanics are shown in figure 2. When the trip was completed, the knob was pulled back to the starting point by hand.

The test board had only two layers of blocks, the under layer 4.4 cm. square, making the groove width at this level 25 cm. A single brass disc, 2 cm. in diameter, was attached solidly to the bottom of the stylus, which was in appearance identical with the practice maze stylus. It could be moved freely in any direction through all the grooves of the board, but could be lifted out only at the exit.

The mazes were placed side by side on tables of the same height. Each was enclosed on three sides by beaver board 76 cm. high, painted light gray (figure 3). Flanges 12.5 cm. wide extending outward at a slight angle helped to prevent peripheral distraction of vision. Gray curtains concealed the mazes when desired.

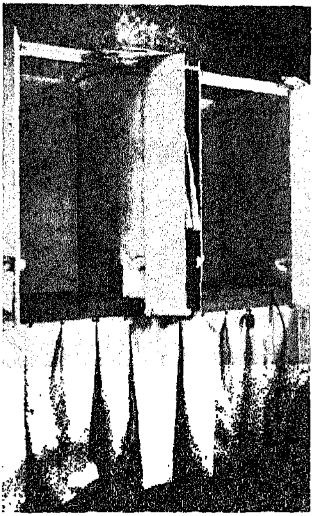


FIG. 3. MAZES READY FOR USE. PRACTICE MAZE TO THE RIGHT; TEST MAZE TO THE LEFT

A chin rest, adjustable to the height of the child, could be attached to the front of the practice maze.

Flash-light bulbs inserted in cardboard cylinders 4 cm. in diameter, with the reflector end cut slanting, were let into the beaver board at the front edges 7.5 cm. above the maze surface. These, on one circuit with 2 *dry cells* for the 4 lights, satisfactorily lighted the small light gray enclosure of the maze. Daylight was dimmed in the room by tan shades at the three small windows. The angle at which the lights were placed allowed the light to be reflected from the surface of the blocks without penetrating into the grooves.

At the correct exit from the test maze, an opening 15 cm. high and 12 cm. long was cut in the beaver board. Through this could be seen a small brass box, 84 by 40 mm., its top slightly above the level of the maze surface. This was wired so that when the child reached the exit by the correct route, the experimenter could touch a button which released the lid catch, allowing the lid to spring open and reveal an animal cracker within the box.

Wiring connections beneath the table were concealed by a curtain. The experimenter sat to the right of the practice maze where she manipulated the motor and the lights. During the tests she stood to the right of the child, where she could watch his performance. A drawing board was supported by the tops of the adjoining beaver board walls of the two enclosures. This held the record blanks and the button operating the cookie box.

The record blank was a reproduction of the maze with wider alleys, on which the experimenter traced the child's path in red pencil.

III. SERIES 1

A. Subjects and procedure

Fifteen children, ranging in age from thirty-five to fifty-seven months in

October, 1933, were the subjects for the first part of the experiment. They were all attending the Child Institute of the Johns Hopkins University.

The children were divided into three groups, matched for chronological age. The Intelligence Quotient for each child had been determined by the Stanford Revision of the Binet Scale, but in view of the doubtful reliability of intelligence ratings with such young children, the Intelligence Quotient was regarded less in the grouping than chronological age and observational estimates of the child's ability in his attack upon problems in his daily play life. The results seem to have confirmed the feasibility of this plan. Table 1 gives the ages and Intelligence Quotients at the beginning of the study.

TABLE 1

Age and Intelligence Quotient of subjects

GROUP I			GROUP II			GROUP III		
Child	Age	I.Q.	Child	Age	I.Q.	Child	Age	I.Q.
	months			*months*			*months*	
A	57	125	F	57	108	K	52	118
B	48	107	G	48	123	L	49	113
C	47	100	H	47	115	M	45	126
D	40	112	I	46	110	N	43	117
E	35	102	J	36	110	O	36	133
Average.		109			113			121

The average superiority of Group III was considered no disadvantage, since the preliminary work with a similar group of children had already shown the method used with this group (mechanical guidance without vision) to be the hardest, and in view of the motor learning theories, it was planned to give this group any advantage that might accrue from superior intelligence. Preliminary work with 6 adults showed that this method presented some difficulty to them also. Only one learned after 3 demonstrations, four required 4 to 6 demonstrations, and one had not learned after 9 demonstrations.

The experimental work on the first training series continued from November 7, 1933, through February 1934. The Institute Christmas holiday includes the month of January, so that there was an unavoidable five weeks interim in the study. As will be seen later, it appeared to affect the learning very little.

Each child was given 6 practice runs and 2 tests at each period. A test followed each 3 demonstrations. If the child succeeded he was given a second test immediately, and a third if he succeeded upon that. The criterion of learning was 3 successive correct reproductions. A small amount of retracing, if his final decision was correct, was not counted against him in these tests, however. If he had not succeeded after ninety-nine to one hundred and two training trials and thirty-three to thirty-four tests, the training was discontinued.

Group I—Visual and Manual Guidance

Children in Group I were allowed both to watch the knob and to grasp it lightly with the right hand as it traveled from the start to the exit. The supposition was that this combination of the two methods of tuition would prove the most effective since it seemed to duplicate the usual combination of visual and tactual-kinesthetic stimuli in the child's every-day learning of eye-hand coördinations.

Group II—Visual Guidance

Children in Group II were allowed only to watch the knob. A chin rest was adjusted to the child's height, and he was instructed to place his hands on the edge of the maze. Further attempts to control head movements seemed inadvisable with such young children. As a matter of fact, most of the children kept their heads quite still so far as the experimenter could observe.

Group III—Manual Guidance without Vision

Children in Group III were allowed only to grasp the knob with their right hands, and follow it around manually without seeing it. A gray curtain hung before the practice maze, and the arm was thrust through a slit. The maze lights were not turned on, so that the darkened interior was a further prevention of any accidental glimpses. This group, also, was allowed vision on the tests, since it seemed desirable to give all 3 groups the same chance to profit from any learning occurring during the tests. With all other conditions constant, any difference in results should be due to the difference in the training.

The experimental room was to the rear of the house, apart from the main play rooms. The furnishings were familiar to the child, and kept constant throughout the experiment. The noise of the converter and motor, the mechanics of the traveling knob, and the lights were all matters of interest at first. Some of the children soon disregarded them, others continued to manifest some curiosity. The ideal arrangement, of course, would have been to have these isolated. However, the children who continued to examine the set-up when allowed were the more alert, older children who were quickest to learn. Consequently, this interest did not appear to act as a distraction.

The child was brought from his play to the experimental room by the experimenter. On the first day he was first shown the test maze and instructed as follows:

"You see all these paths. Here is a little knob that will go anywhere I move it. Now watch and see what happens when I make it go a certain way."

The experimenter quickly moved the knob through the correct path to the exit, and opened the cookie box. The child was encouraged to look in and take the cookie. He was told that he might have it when he left. He was then shown the practice maze. Children of Groups I and II were told:

"Now I am going to show you on this board the way that little knob must go to make the box open. This little knob will only go the right way, and you may watch it. You must watch it carefully and learn the way it goes, so that you can make that little knob go the same way. I will let you watch it several times, and then you may try it on that board. When you get it right the box will open."

For Group I, the further instructions were:

"Put your fingers on the knob. Don't hold it tight."

For Group II, the addition was: "Put your chin here and your hands here."

Children of Group III, when taken to the practice maze, were told:

"I am going to let you put your fingers on the little knob here and feel the way that little knob must go to make the box open. This little knob will only go the right way, and you may feel it, but the game is not to see it. You must pay attention and learn the way it goes, so that you can make that little knob go the same way. I will let you feel it several times, and then you may try it on that board. When you get it right the box will open."

After each trip of the stylus, the curtain was dropped before the maze, the lights turned off, and the knob drawn back to the starting point. This short interval served as a brief rest period for the child.

After 3 guided runs, the child was led quickly to the test maze and told, "Show me the way it went." The experimenter drew a record of the child's performance in red pencil upon the record sheet. Time was taken with a stopwatch.

After the first period, the instructions were merely "Watch (or feel) carefully the way it goes, so that you can show me and make the cookie box open." Exhortations were confined to: "Watch (or feel) carefully;" "Watch (or feel) where the turns are;" "Try to remember the way it goes," and "You must learn the way the little knob goes if you want to make the cookie box open."

In the beginning each child was taken only twice a week. This proved unsatisfactory both from the point of view of time consumed in the series and for the child's optimum learning. From the first week in December on, each child was taken every day apart from the unavoidable interruptions due to illnesses and holidays.

B. Results: Series 1

From the record sheets, the following data were used as indications of learning: (1) the number of trials to learn; (2) the total distance covered by the child, measured in number of blocks passed, and the average number of blocks passed per test; (3) the total number of turns and the average number of turns per test; (4) the total number of right turns and the average number of right turns per test. The form of the learning curve, and the order of fixation of the turns were observed as of incidental interest. In addition, comments and illustrations of particular features of the learning in individual instances may furnish valuable insight into the process.

Number of Trials. Table 2, column 3, shows these data.

No child under forty-eight months of age learned the maze. Whether Child N would have learned it, had his practice continued, cannot, of course, be stated definitely, but in view of the fact that the three older children in his group did not learn it, it seems extremely doubtful.

TABLE 2

Number of trials and tests, average number of blocks passed, average number of turns and average number of correct turns for each child in Series 1

Less than 99 practice trials indicates that the child successfully completed the learning

CHILD	AGE	NUMBER OF PRACTICE TRIALS	NUMBER OF TESTS	AVERAGE NUMBER OF BLOCKS PER TEST	AVERAGE NUMBER OF TURNS PER TEST	AVERAGE NUMBER OF RIGHT TURNS PER TEST
Group I. Visual and manual guidance						
	months					
A	57	69	29	16.2	16.5	5.2
B	48	78	29	17.6	20.3	4.5
C	47	102	34	10.5	19.4	1.5
D	40	102	35	18.8	15.0	2.2
E	35	102	34	8.8	17.9	0.6
Average				14.4	17.8	2.8
Group II. Visual guidance only						
F	57	36	14	16.6	11.9	4.8
G	48	36	15	14.3	8.3	6.1
H	47	102	34	20.4	10.4	1.03
I	46	102	35	13.4	9.5	4.6
J	36	99	33	23.2	14.9	1.05
Average				17.6	11.0	3.5
Group III. Manual guidance only						
K	52	102	34	16.5	12.6	2.9
L	49	102	34	20.3	14.7	2.9
M	45	99	33	19.4	11.6	2.2
N[1]	43	54	18	15.0	8.0	2.7
O	36	102	33	17.9	11.1	0.9
Average				17.8	12.5	2.3

[1] Due to illness, Child N did not complete the learning series.

Of the four children who learned, the two who were given only visual guidance learned with approximately half as many demonstrations as did those who were allowed to place their hands upon the knob as it traveled. These children were remarkably well matched. The average age and Intelligence Quotient of the two in Group I were identical with those of the two in

Group II. Child A and Child G, the two with the higher Intelligence Quotients, were rather negativistic and bored with the "game"; Child B and Child F were coöperative and interested. Thus, factors other than the difference in training method seem to cancel out. So far as any conclusions can be drawn from the performances of four children, with respect to the number of trials, visual demonstration alone was superior to manual guidance with vision.

None of the children in Group III learned the maze. The two oldest were fully the equal of the successful children in general ability, and were two of the most coöperative and interested children in the experiment. Apparently manual guidance without vision (though with vision allowed on the tests, so that they were not unfamiliar with the appearance of the maze) was an ineffective method of training in this experiment.

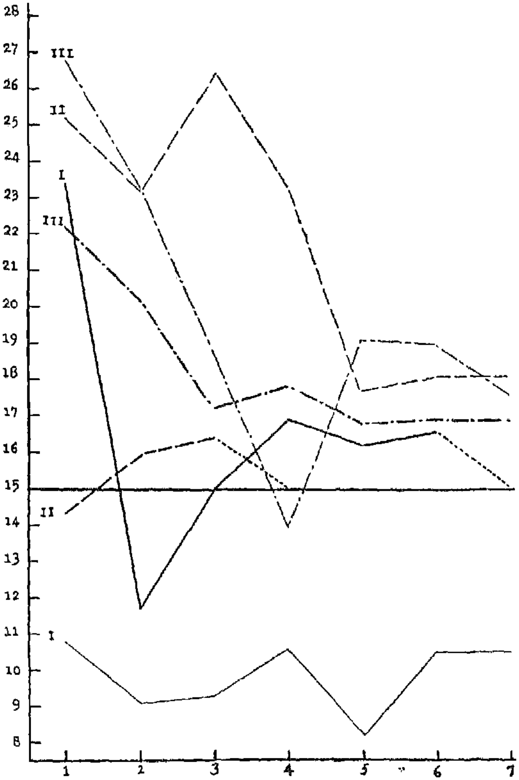
Since the ratio of tests to demonstrations was 1:3, except when the child was successful, extra tests indicate isolated successes. Table 2 indicates that Child A made four successful reproductions before he was successful three times in succession. The first of these occurred after 57 demonstrations. Child B also produced one additional true pattern, also after 57 demonstrations. Child G succeeded once after 30 demonstrations. Child D and Child I, although neither reached the criterion of three correct runs, each have one correct pattern to their credit. No child in Group III made even one correct reproduction of the path through which his hand was guided 100 times.

Distance covered. Table 2, column 5, shows the average distance per test covered by each child. Table 3 gives the averages in each successive five tests. The length of the true path was 15 blocks. Group I is nearest to the standard on the average, Group II next, and Group III last.

Inspection of these data reveal small differences between the records of the groups as wholes, or between the performances of those who did and did not learn. The individual differences are much higher than the average differences. Either distance covered is not a criterion of learning in this type of maze, or the number of subjects is not large enough to demonstrate definite trends. Graphic analysis, however, gives an indication of some differences which might or might not be verified in study of a larger group.

Graphs 1 and 2 are drawn from the average number of blocks per each five tests (table 3). Graph 1 shows group averages for the successful and unsuccessful children in Groups I and II compared with the average of their mates in Group III; graph 2 shows individual curves for Child D and Child I who each achieved one successful reproduction, and their mate in Group III, Child N, who did not complete the practice series.

These curves show that the *successful* children in Group I began with much excess distance, which they eliminated, while the *successful* children Group II began below the standard and worked up. With the *unsuccessful* children, the exact reverse is true. The children on the borderline who produced one successful test but not three conform to the tendency for the *successful* children of their group (graph 2). The curves for Group III, all unsuccessful, show much excess distance with the exception of Child N (graph 2) whose average deviation in 18 tests is zero. Small average deviations, obviously, accompany good performance, and it is a matter of par-

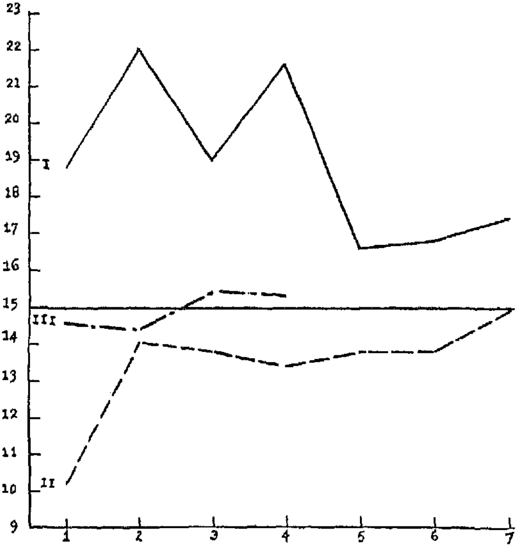


GRAPH 1. NUMBER OF BLOCKS COVERED IN AVERAGE OF EACH FIVE SUCCESSIVE TESTS IN SERIES 1

Curves for successful children in the seeing groups and their mates in Group III (heavy lines) compared with curves for unsuccessful children in the seeing groups and their mates in Group III (light lines). Group I: average A and B ———; average C and E ———; Group II: average F and G — —; average H and J — - -; Group III: average K and L —.—; average M and O —.—

ticular regret that his trials could not be continued. It would be possible, on this maze, however, as his performance shows, to approximate the correct distance throughout the tests and yet never achieve the true pattern.

which useless movements are slowly eliminated. Yet with manual guidance alone, complete learning in this problem did not occur. The addition of vision was necessary to bring success. Moreover the short curve of



GRAPH 2. NUMBER OF BLOCKS COVERED IN AVERAGE OF EACH FIVE SUCCESSIVE TESTS IN SERIES 1

Children successful on one test, but not on three in succession, and their mate in Group III. Group I: Child D ———; Group II: Child I — —; Group III: Child N —.—

These differences in the direction of the deviation may be due only to individual variations in so small a group. On the other hand, they may reflect the effect of manual guidance. Where manual guidance was given exclusively or in part, such learning as occurred was characteristic of the motor type in Group II is very much like the second half of the curve of Group I. This suggests the possibility, at least, that the children who had visual demonstration only (Group II) did their preliminary exploration visually, and that those who failed to do so in this group, failed to learn the maze.

TABLE 3

Distance and turns for each child as shown by the average for each five successive tests

Group I

Average number of blocks per five tests

A	20.8	11.8	14.4	18.4	15.4	17.0	
B	26.4	11.6	15.6	15.4	17.0	16.2	
C	13.4	6.8	7.8	10.6	10.2	12.8	15.5
D	18.8	22.0	19.0	21.6	16.6	16.8	17.4
E	8.2	11.4	10.8	10.6	6.2	8.2	5.5
Average...	17.5	12.7	13.5	15.3	13.1	14.2	12.8

Average number of turns per five tests

A	12.2	5.8	10.2	12.8	8.8	12.5	
B	14.0	11.2	10.0	9.2	11.6	9.6	
C	4.2	2.2	2.4	6.4	6.2	8.8	10.0
D	11.8	17.2	12.2	15.6	15.6	13.2	14.4
E	4.4	7.0	9.4	5.4	1.6	2.6	0.8
Average...	9.4	8.7	8.8	9.9	8.8	9.3	8.4

Group II

Average number of blocks per five tests

F	14.8	17.2	18.2				
G	13.8	14.6	14.6				
H	27.8	24.4	22.8	20.6	12.8	16.4	17.3
I	10.2	14.0	13.8	13.4	13.8	13.8	15.0
J	22.6	22.0	30.0	26.0	22.6	19.8	18.9
Average...	17.8	18.4	19.9	20.0	16.4	16.7	17.0

Average number of turns per five tests

F	9.8	13.6	10.0				
G	9.0	9.0	8.4				
H	10.0	14.8	12.0	12.4	5.8	7.4	8.4
I	7.8	9.8	10.2	9.2	9.6	9.8	9.8
J	9.0	13.0	15.2	16.4	16.6	13.0	12.3
Average...	9.1	12.0	13.2	12.7	10.7	10.1	10.2

Group III

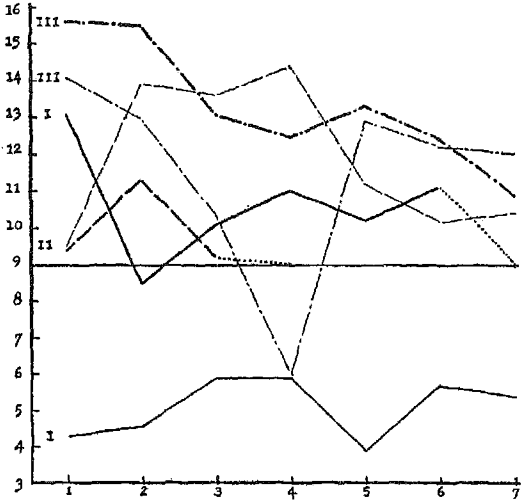
Average number of blocks per five tests

K	12.2	15.0	16.4	20.2	19.2	18.6	13.2
L	33.2	25.4	18.0	15.4	14.4	15.2	20.5
M	15.0	27.4	25.0	15.0	20.0	22.0	17.0
N	14.6	14.4	15.4	15.3			
O	28.6	19.2	12.6	13.0	18.2	16.0	18.3
Average...	20.7	20.3	17.5	15.8	17.9	17.9	17.3

Average number of turns per five tests

K	10.4	10.4	11.6	14.2	17.0	13.8	10.0
L	20.8	20.6	14.6	11.8	9.6	11.0	11.8
M	10.0	12.6	12.4	7.2	11.2	16.4	11.0
N	8.6	8.4	8.0	6.3			
O	18.2	13.4	8.4	5.8	14.6	9.0	13.0
Average...	11.8	13.0	14.4	11.2	13.6	13.6	10.1

Number of turns. Table 2, column 6, gives the data for the number of turns. The correct number of turns was 9. The average for Group I is closest to the standard, that for II next and III last. This is the same order that was shown for distance, though the differences were not quite so large. In either case, the number of subjects and the size of the difference is not large enough for statistical reliability. But if the direction of the differences is taken at face value, then it appears that the combination of visual and manual guidance in Group I was most effective in producing the correct amount of distance covered and the correct number of turns, *on the average.* None-the-less, the correct reproduction of the pattern occurred much sooner by the second method.



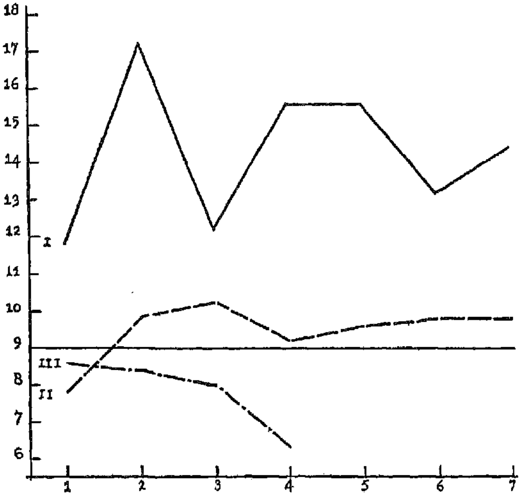
GRAPH 3. NUMBER OF TURNS IN AVERAGE OF EACH FIVE SUCCESSIVE TESTS IN SERIES 1

Curves for successful children in the seeing groups and their mates in Group III (heavy lines) compared with curves for unsuccessful children in the seeing groups and their mates in Group III (light lines). Group I: average A and B ———; average C and E ————; Group II: average F and G — —; average H and J — —; Group III: average K and L —.—; average M and O —.—

The curves drawn from the averages of turns for 5 successive tests in table 3 show the same general characteristics as those for distance. Comparison of the two sets helps to summarize the observations possible from these measures of the learning. In the following, 15 blocks and 9 turns are taken as the "standards" in distance and turns, and deviations above or below these are called simply plus or minus variations.

In Group I the *successful* children vary in distances from 8.4 to −3.3 blocks, or through 11.7 blocks; the *unsuccessful* from −4.2 to −6.8 blocks, or through only 2.6 blocks. In turns, the *successful* children varied from +4.1 to −.5 turns, or through 4.6 turns, while the *unsuccessful* varied from −3.1 to −5.1, or through 2.0 turns. Requirements for success by this method of guidance, then, appear to be: (1) a considerable amount of excess distance to be eliminated; (2) some excess in turns, but not so much as in distance. *Failure* apparently resulted from lack of initial excess activity, or random exploration.

In Group II the *successful* children varied from −.7 to +1.4 blocks, or through 2.1 blocks; the *unsuccessful* from +11.4 to +2.7, or through 8.7 blocks. In turns the *successful* children varied from +2.3 turns to 0; the *unsuccessful* from +5.4 to +.5, or through 4.9 turns. *Success from this method of guidance*, then, appears to require almost no excess activity in distance and a similar close adherence to the standard in turns, with about the same amount of variation in each. *Failure* in this case resulted from ex-



GRAPH 4. NUMBER OF TURNS COVERED IN AVERAGE OF EACH FIVE SUCCESSIVE TESTS IN SERIES 1

Children successful on one test, but not on three in succession, and their mate in Group III. Group I: Child D ——; Group II: Child I — —; Group III: Child N —.—

cess activity both in distance and in turns.

In Group III, manual guidance only, the deviation from the standard is strongly positive in all cases except for the one point below the standard in graph 3.

It is tempting to speculate here. The manual guidance without vision resulted in excess motor activity, rather undirected, in which a slow approach to the correct distance and number of turns occurred, but the pattern was not learned. As a previous author observed, kinesthesis may indicate that a turn is to be made, but visual or tactual cues are needed to indicate where. Members of Group I perhaps reacted to the manual guidance first, and their records show the motor pattern in the beginning. Later, when unsuccessful, they changed to a visually guided reaction. Those who were allowed only to watch the knob possibly gave their whole attention from the beginning to the visual guidance of their hands in the test situation.

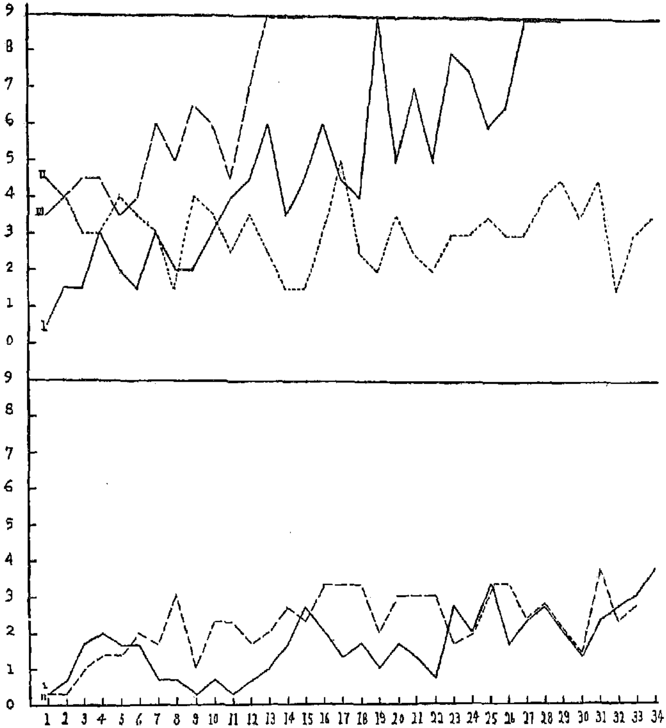
Whether verbalization entered into the learning or not was not ascertained in this study.

The individual curves, (graphs 2 and 4) illustrate partial learning in Child D and Child I, and incompleted series for Child N. Child D did not improve on the average in number of turns, but did improve in distance. Child N, though he judged the distance very well, was slowly departing from the standard in number of turns.

Number of right turns. The type of maze used offered scoring difficulties. Whereas in the ordinary maze, each excursion into a cul-de-sac must be followed by a return to the correct path at the same point where it was left if the exit is to be reached, in this maze the subject might leave the true path at any point and join it again later, or not at all, after any amount of random exploration. Where the record contained more or less than the requisite 9 turns, even though a few of the turns were at the correct point, it was not possible to be sure which part of the pattern the child had intended that particular section to represent. The method finally adopted to overcome the difficulty was simple. Turns were counted as correct if they occurred at the correct point in consecutive order counting *either* from the *beginning* or the *end* of the pattern. Thus, if a line in the right direction traveled around turn 6, it was counted as correct if, in the child's pattern, it was the sixth turn from the beginning or the fourth turn from the end. According to this scheme, table 2, column 7 shows the results.

This record gives a more accurate reflection of the child's performance than does the distance or the total number of turns. Here the group averages are in agreement with the fact that children of Group II learned in fewer trials than those of Group I. Child N, whose total distance and turn scores were so much nearer the standard than those of others of his group, none-the-less had no more right turns than the majority of the others. Child I, it is true, has as high a score as some who were successful, but his record shows that he repeated a pattern a great many times in which a number of the turns were correct without correcting the few mistakes.

The most striking fact throughout this analysis is that no differences can be shown which are in any way large enough to account for the fact that Children F and G learned the pattern in half as many trials as Children A and B. The averages of distance covered, of turns per test, and of right turns per test are different from those of the children who did not learn the maze, but not strikingly different from each other. Only in the graphic repre-



GRAPH 5. LEARNING CURVES CONSTRUCTED FROM THE NUMBER OF CORRECT TURNS PER TEST

A. Group averages for successful children in the seeing groups and their mates in Group III. B. Group averages for unsuccessful children in the seeing groups.

sentation of the *direction of deviation,* do we find a clue which might point to a solution of the problem, namely: that the 2 children who learned with the aid of motor guidance tended toward excess motor activity in the beginning, while those who only watched the knob avoided this preliminary stage.

The form of the learning curve. Graph 5 shows the learning curves, constructed from averages of the number of right turns per test of Children A and B, F and G, K and L, C, D and E, and H, I and J. Group differences are marked. The successful children in Group II started at a higher level than those of Group I. On the first trial they attained a score not reached by the two children of Group I until the twelfth test. Again, the saving by this method is shown to have been in the first half of the learning curve.

The curve for the average of Children E and L in Group III ends at exactly the same point as it began. It even has a slight downward slope for the first half of its course, although it began nearly as high as the curve for Group II. In fact it appears to represent admirably the efforts of a person groping in the dark. The curve for the remaining three children in Group III has not been included since it is similar to this although upon a lower level.

The curves for the unsuccessful children in Groups I and II are consistent with those shown by the successful children and display the same differences at a lower level. Although in this case they begin at the same point, the curve for Group II never sinks to the starting level again after the second test, while Group I falls to the starting point again on the ninth and eleventh tests. The rise of the curve in its first half is steeper in II than I and the high level is maintained more consistently in the former.

TABLE 4

Relative difficulty of turns in the maze

	TURN NUMBER								
	1	2	3	4	5	6	7	8	9
Times correct	352	125	39	36	35	104	135	146	215
Rank in difficulty	(1)	(5)	(7)	(8)	(9)	(6)	(4)	(3)	(2)

Order of fixation of turns. From the total number of times each turn was correctly negotiated, the order of difficulty of the turns in the maze was calculated. This is shown in table 4.

This is consistent with other studies which have shown the first and last items of a series to be the first learned, while the middle items are the hardest. In this case the third, fourth and fifth turns proved about nine times as hard as the first turn and about six times as hard as the last.

Comments upon individual performances. There were several varieties of failure, which no mathematical treatment of the records can bring out. They reflect both the results of the method of guidance and the personal reaction of the child. Some of these are the following:

1. Aimless wandering. Child M's record was typical. He started out well, but apparently was lost after the third turn and retraced up and down the grooves until stopped at the end of 45 seconds by the experimenter.

2. Quick, impulsive action with (a) no apparent attempt to reproduce the pattern, or (b) a very much abbreviated pattern.

3. An attempt to produce a pattern, but with no similarity to the true pattern.

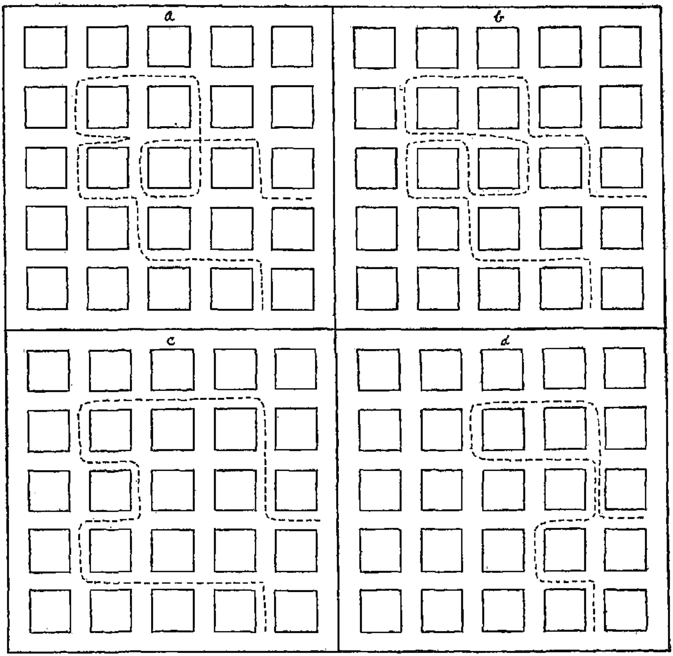


FIG. 4. INDIVIDUAL RECORDS

a. Child K, age 52 months. Test 1 after 81 guided trials, time 19 seconds. *b*. Child K age 52 months. Test 1, after 87 guided trials. Time not taken. *c*. Child L, age 49 months. Test 1 after 75 guided trials, time 18 seconds. *d*. Child L, Test 1 after 96 guided trials, time 9 seconds.

4. The best records of the oldest children in Group III are extremely interesting. They show varying approximations to the pattern in the

effort to reproduce a series of unseen hand and arm movements. Child K (see figure 4) evidently felt he should go around the middle block, but could not find the way to start. Child L has the number of turns correct in both records, also the direction of the turns and some of the proportions. Such records as these often occurred just before learning among the older children in Groups I and II. Child L never eliminated these errors.

TABLE 5

Age and intelligence quotients of children for the second series of demonstrations

1. *Reduced maze,* trials and tests as in Series 1

CHILD	AGE	I.Q.	CHILD	AGE	I.Q.
Group I. Visual and manual guidance			Group II. Visual guidance only		
	months			*months*	
C	51	100	H	51	115
D	44	112	I	50	110
E	39	102	J	40	110
Group III. Manual guidance only			Group IV. No vision on tests or trials		
K	56	118	R	52	96
L	53	113	S	50	123
M	49	126	T	43	111
O	40	133			

2. *Original maze,* no vision on tests or trials

CHILD	AGE	I.Q.	CHILD	AGE	I.Q.
Group Va. No previous trials			Group Vb. Previous success with vision		
P	58	98	F	61	108
Q	49	117	U	54	140
			B	52	107
			G	52	123

IV. SERIES 2

A. *Subjects and procedure*

At the completion of the first series of 100 demonstrations for each child, the following questions arose:

1. Since the problem, as it stood, was too hard for the younger children of the two seeing groups, would it be possible for them to learn it if it were simplified by shortening the maze?

2. Could any of the children of the non-visual group learn the path if it were simplified by shortening?

3. Was the introduction of vision on the tests for the non-visual group really a confusing rather than facilitating procedure?

4. Could children who had once learned the maze with vision relearn it without vision?

To settle these questions, a new series of 100 demonstrations each was given to six groups, under the conditions indicated in table 5. The age is given as of March 1, 1934, when this series was begun.

The original maze was shortened, as shown in figure 5, by covering the outer row of blocks on two sides of the maze with an L-shaped sheet tin lid, painted the same color as the maze. Four turns, the first two and the last two, were thus cut off from the original pattern, making the length of the true path 9 blocks, and the number of turns, 5. Since in the original, the end of the path was clearly marked by the exit from the maze, the finish in this reduced pattern was marked by the three small gold stickers shown in this diagram.

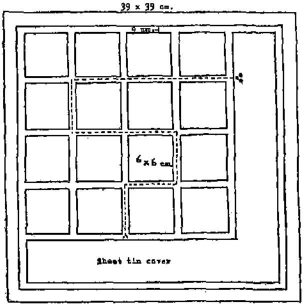


FIG. 5. SURFACE VIEW OF REDUCED MAZE
The dotted line indicates the path traveled by the knob on the practice maze.

Groups IV and Va were instructed just as Group III had been previously, but when they were taken to the test board the curtain was not removed.

Group Vb was told:

"You remember how we played this game the last time. You learned the way the little knob went, and you made the cookie box open. The little knob still goes the same way it did before. I want to see if you can make the cookie box open when you cannot see the way the knob goes."

Groups I, II, and III were told: "You see, I have covered up some of the blocks in the game. The little knob does not make so many turns, and it may be easier for you to remember the way it goes.

"We will play this game just the way we did before. When you make the little knob go the right way the box will open. I will show you the right way over here, and you will show me there."

The rest of the procedure was precisely the same as in the previous series.

B. Results: Series 2

Number of trials. The results of this series are presented according to the same scheme as that for the previous series. Table 6 shows the number of trials for each child.

Table 6 answers the questions stated. No child who was not permitted vision on the tests or trials (Groups IV, Va, and Vb) learned the maze, not even children in Group Vb, who had previously learned it with vision. Not one of these children, in fact, produced even one correct pattern.

Three of the younger children, who had not learned the full maze in the seeing groups, learned the reduced maze. Child D, and Child I, both of whom produced one correct test on the full maze but were unable to reach the criterion of 3 perfect tests, learned this easier pattern after very few demonstrations. Child I, having visual guidance only, learned after 6 trials, just half as many as were needed by Child D, who received visual and manual guidance. This is exactly the same ratio as obtained between the number of trials required for successful learning by the older children trained by these methods in Series 1.

TABLE 6

Number of trials and tests for each child

Less than 99 trials indicates that the child successfully completed the learning

Reduced maze

CHILD	AGE	TRIALS	TESTS	CHILD	AGE	TRIALS	TESTS
Group I. Visual and manual guidance				Group II. Visual guidance only			
	months				*months*		
C	51	102	34	H	51	102	34
D	44	12	7	I	50	6	4
E	39	78	28	J	40	99	33
Group III. Manual guidance only				Group IV. No vision on tests or trials			
K	56	15	7	R	52	102	34
L	53	102	34	S	50	102	34
M	49	102	34	T	43	102	34
O	40	102	34				
Original maze. No vision on tests or trials							
Group Va. No previous trials				Group Vb. Previous success with vision			
P	58	99	33	F	61	99	33
Q	49	102	34	U	54	99	33
				B	52	99	33
				G	52	102	34

Child E (Group I) learned the maze in 78 trials, while Child J (his partner in Group II) did not complete the learning. This is the only instance in which the combined manual and visual guidance appeared superior to the visual only. This might be due to individual variations. On the other hand, we may have here an indication that manual guidance actually is more efficacious at about three years and under. However, a special circumstance should be related in this case. This child never appeared to comprehend the instructions very clearly. After the thirteenth test, when the experimenter had brought him back to the practice board for the fortieth trial, she said, "I believe you really know the way that little knob goes. It starts here, and where does it go next?" To her amazement, he indicated the correct path with his finger, and could do it as many times as asked. He was then taken back to the test board and told: "Now do just what you did over there. It starts here, and where does it go next?" He was unable to produce the correct pattern on the test board, although he approximated it. Thereafter the trials and tests continued as before, the experimenter saying for each test: "Where does it go next?" The child did not succeed in the usual manner on the test board until after twice as many trials as this demonstration on the practice board required, and it is probable that he could have shown the way earlier on the practice board if he had been asked. Possibly he had observed small cues there which pointed out the path to him without his actually having learned it. No other child was found who exhibited this ability on the practice board, or to whom the change in the wording of instructions seemed to make any difference, although others of the younger group were tried after this discovery.

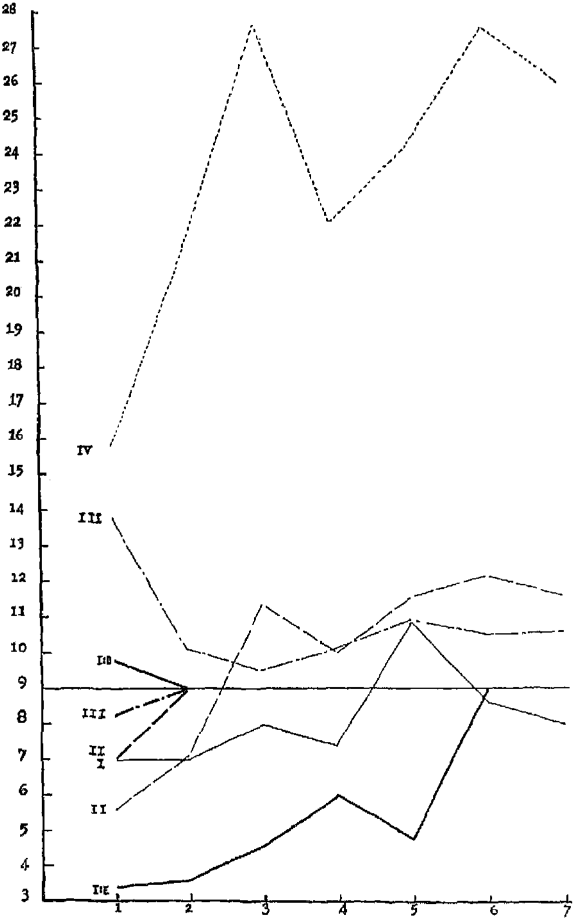
Child K (Group III), learned the pattern to the point of three correct reproductions after fifteen trials on the reduced maze with manual guidance only. Child K was the oldest child in Group III. Kinesthesis, far from being the best guide at the youngest ages, was only beginning to be an adequate guide for a child almost five years old, and this when vision was allowed in the test situation.

Distance covered. The total distance covered by each child and his average distance per test and per five tests were calculated for this series as in the previous series. The complete table has been omitted as unnecessarily cumbersome. The length of the true path for the reduced maze was nine blocks.

The same trends observed in the first series were even more evident here. Group averages of the number of blocks covered per test compared with the standard show the following deviations: On the reduced maze, Group IV +14.2 blocks, Group III +1.3 blocks, Group II +.6 blocks, Group I −1.4 blocks; on the full maze, Group Va +12.2 blocks, Group Vb +1.2 blocks. The ranking of the groups by average deviation (in which the positive and negative deviations are disregarded) is the same as that above except that Groups I and II change places, Group I having a higher average deviation than Group II.

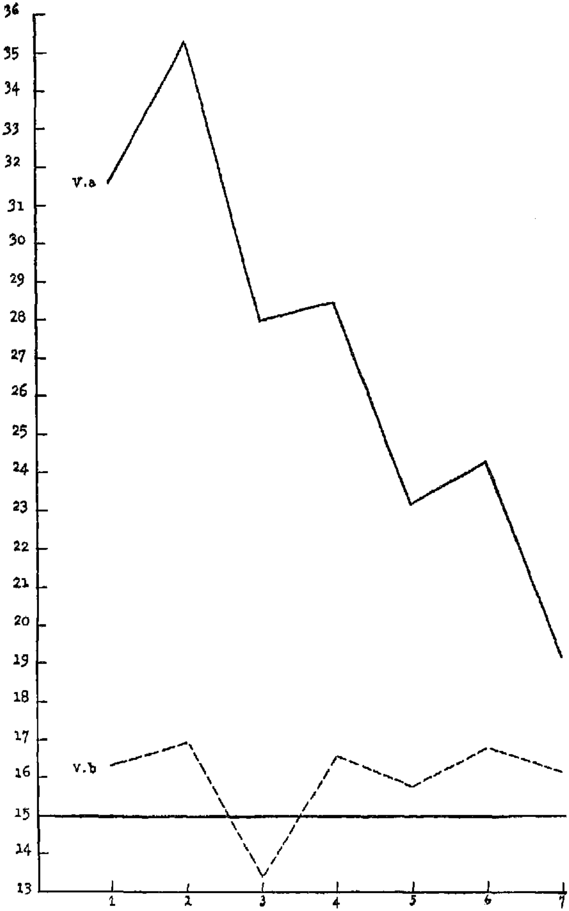
These results emphasize once more that vision tends to reduce random motor exploration. The introduction of vision in the test situation in Group III of Series 1 was an aid, not a confusing factor. Groups IV and Va, composed of children who had not previously been trained on the maze and who were allowed vision on neither the practice nor the tests, show the largest amount of excess distance covered. Next in order is Group III, children who had never had visual guidance. Group IVb ranks next, although there is only 0.1 block difference between this and Group III. These children had previously learned the maze with vision, but were allowed no vision either on practice or on tests in this series. The effects of the previous visual training about equalled the effects of vision on the tests.

It might be expected that Group I should rank next in order as showing the effects of the manual guidance, and Group II last. In Series 1, as we noted there, the same reversal occurred, due to the wider negative deviation of



Graph 6. Reduced Maze. Number of Blocks Covered in Average of Each Five Successive Tests in Series 2

Curves for successful children (heavy lines) compared with curves for unsuccessful children (light lines). Group II. I is not an average of five tests, but the actual tests, as there was only one previous to success. Group I: D and E ———; C ————; Group II: I — —; average H and J — —; Group III: K —.—; average L, M, O —.—; Group IV: average R, S, T ....



GRAPH 7. ORIGINAL MAZE. NUMBER OF BLOCKS COVERED IN AVERAGE OF EACH FIVE SUCCESSIVE TESTS IN SERIES 2

Group Va: average P, Q ———; Group Vb: average F, U, B, G — —

the unsuccessful children overbalancing the positive deviation of the successful in Group I. Here the same explanation would hold were it not for the case of Child E, already described as unusual. The effect of one record in so small a number of cases unfortunately calls all the group results into question.

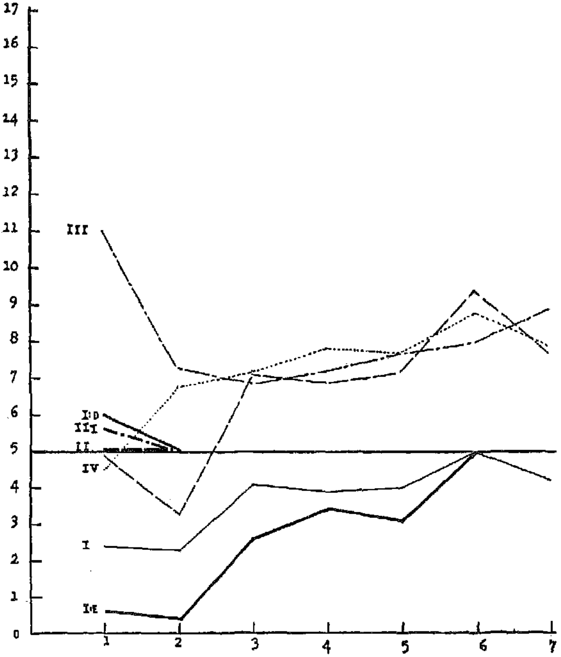
Graphs 6 and 7 drawn from the averages of successive five tests illustrate the above observations and are in most respects consistent with the findings from the previous series. With the exception of Child E, the younger children who were successful on the reduced maze were those who had been on the verge of learning the larger maze and a very few trials on this easier problem sufficed to bring them to the criterion of three perfect tests. Child E is an exception to the previous progress of successful children in Group I. Child K, the only child in any series successful by the manual guidance alone, is surprising in that his short curve is like that of Group II instead of Group I.

Number of turns. The number of turns for each child was also counted and treated as in Series 1. It was noted that while the amount of deviation from the standard for Groups I, II, III and IVa was very nearly the same for distance and for turns, with Groups IV and Va the deviation from the standard in distance was about 7 and 2 times, respectively, the deviation from the standard in number of turns. The absence of visual guidance on both trials and tests encouraged random retracing and a maximum of distance covered with a minimum of turns.

The form of the learning curve. The number of correct turns for each child was determined by the method described in Series 1. The group averages for the number of right turns per test is as follows: Group I, 1.8; Group II, 2.1; Group III, 1.5; Group IV, 0.2; Group Va, 0.7; Group Vb, 2.5. (See graphs 8 and 9.) The surprising feature here is that Group Vb has the highest average, although not one child produced an entirely correct test. The effects of the previous success with vision were strong enough to bring these children to the first rank by this criteria, whereas children learning by the same method who had had no previous practice series (Groups IV and Va) ranked last. Children who had had as much previous practice in Series I without vision on the practice but with vision on the tests ranked fourth in order. As in the previous series, Group II was the best of the three original groups.

The unsuccessful children in Groups I, II and III differ from those of the previous series in that Groups I and II show no upward trend, Group III does after trial 26. It is probable that the children who did not learn with vision at this level never comprehended the problem, and that the slight upward trend of the curves of unsuccessful children in Series 1 was due to the presence in the group of the children who were successful on the reduced maze of Series 2. In Group III the older children began to succeed a little better with the easier problem.

In summary, the results of Series 2 show that the reduction in size of the maze made the problem of about the same difficulty for the younger children that the original maze was for the older ones. Learning without visual guidance was more difficult for the older children of Group III on the short maze than the original maze had been for the younger children of the seeing groups. Learning without vision on the tests or practice was by far the most difficult method of all. In most respects the indications from Series 1 were confirmed by Series 2, where the same phenomena appeared upon a lower level. The less visual and the more manual the training and testing, the more random motor ac-



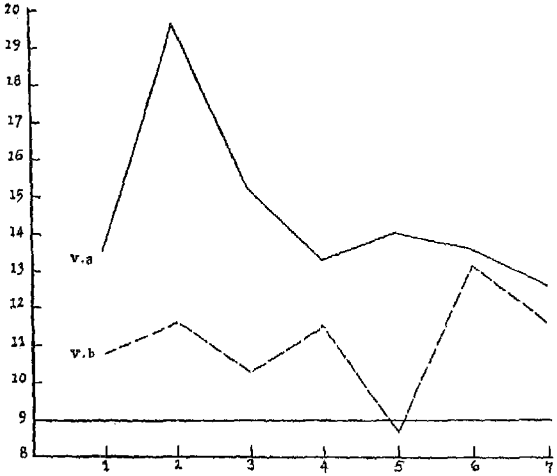
GRAPH 8. REDUCED MAZE. NUMBER OF TURNS IN AVERAGE OF EACH FIVE SUCCESSIVE TESTS IN SERIES 2

Curves of successful children (heavy lines) compared with curves of unsuccessful children (light lines). Group II, I, is not an average of five tests but the actual tests, as there was only one previous to success. Group I: D and E ———; C ————; Group II: I — —; average H and J — —; Group III: K —.—; average L, M, O —.—; Group IV: average R, S, T ....

tivity occurred, and the less was the likelihood of success. Such a decided contrast probably would not be found with a different type of maze in which random activity itself would be likely to produce eventual success.

Comments upon individual performance. Some varieties of failure became more obvious in this second series than they had been in the first. Aimless wandering was carried to the extreme in the non-visual groups, with emphasis upon retracing. Child P's record on the long maze, shown in figure 6, is an example of this tendency.

In connection with observations by the early child psychologists upon the lack of orientation in children's drawings, and particularly in connection with Rice's recent study of this feature, the record of Child J (figure 7) is interesting as an example of a pattern which recurred many times, among the unsuccessful children. This reversal of the pattern in turning left instead of right at the first turn also occurred in the long maze at this point, where it was the third turn instead of the first. Once this had appeared, it seemed especially difficult to eradicate. Thirteen of Child J's tests, 14 of Child L's, 15 of Child M's and 8 of Child O's records were of this pattern. All the children of Group III, in fact, seemed unable to correct this error. The kinesthetic impulses evidently in-



GRAPH 9. ORIGINAL MAZE. NUMBER OF TURNS IN AVERAGE OF EACH FIVE SUCCESSIVE TESTS IN SERIES 2
Group Va: average P, Q ———; Group Vb: average F, U, B, G — —

dicated a turn, but not the direction of the turn. Child M, after 90 trials and his thirtieth test, remarked "Well, that's wrong, but that's the way it went, though."

Child O was the only one who seemed confused by the change from the large to the smaller maze. His record, shown in figure 7, is peculiar in that he actually reproduced the pattern in his first five turns several times, but he never learned to stop after this performance. Instead he continued as shown in his record. He appeared to be trying to get to the exit from the long maze, where the cookie box was.

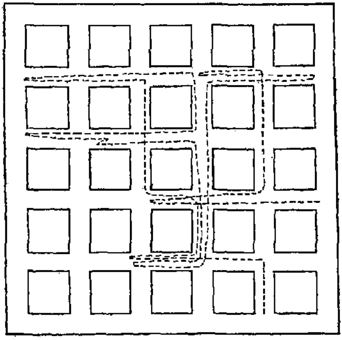


FIG. 6. INDIVIDUAL RECORD OF CHILD P, 58 MONTHS OLD
Test 1 after 18 guided trials, time 39 seconds

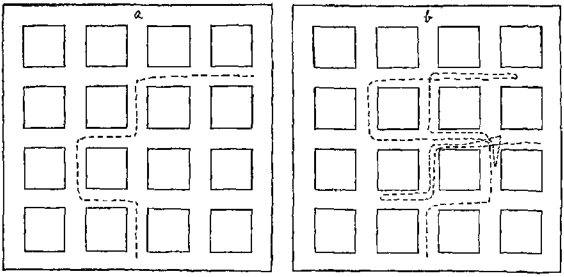


FIG. 7. INDIVIDUAL RECORDS
a. Child J, 40 months old. Test 1 after 87 guided trials, time 7 seconds. *b.* Child O, 40 months old. Test 1 after 81 guided trials, time 20 seconds.

CONCLUSIONS

The goal of this study was to set up a problem in which children must learn a motor task by one of three methods: (1) through predominantly visual cues, (2) through predominantly manual cues, or (3) through a combination of the two. If there is a tendency for children to depend primarily upon kinesthetic cues other than visual, it was hoped this experiment would demonstrate that fact.

There were 21 children in the experimental group. This small number of cases prevents the statement of definite conclusions. Nevertheless, the results appear to present very definite indications in some directions, while other more tentative findings open interesting avenues for speculation.

There is little doubt that the method of training in which manual guidance without vision was employed was much less effective in producing successful learning than were the visual methods. Preliminary trials with 6 adults had shown that manual guidance without vision presented a real problem to them in reproduction, but the assumption that the adult has shifted to visual dominance while the young child relies mainly upon tactual-kinesthetic cues, would lead us to expect the opposite results with children. This was not the case.

The facts upon which the relative difficulty of the non-visual method is asserted are the following: (a) No child in the non-visual group (no vision in the guided practice trials, vision on the tests) learned the correct pattern in the long maze, whereas four older children in the visual groups (vision on both practice trials and tests) did learn it. (b) When the maze pattern was shortened, only the oldest child in the non-visual group learned the pattern, while 3 of the younger children in the visual groups learned this easier task. (c) Vision on the tests only was of considerable benefit, as shown when the non-visual group of Series 1 was compared, in Series 2, with a group allowed no vision either in practice or in tests. By the criteria of distance covered, number of turns, and number of correct turns, the first group came much nearer to the standard than the second. It is probable that the vision in the tests was in some ways comparable to the insertion of visual trials. (d) Children who had once learned the maze with the aid of vision were unable to relearn it without vision on practice or tests, although the effects of their previous visual training were obvious when distance and turns were compared with the other non-visual groups.

Differences between the two visual groups (visual guidance only, and visual and manual combined) are not so definite, but tend to show that visual guidance alone is superior to the combination. This conclusion rests mainly upon the comparative number of trials required by the successful children in both groups. Success by the visual guidance was attained in half as many trials as by the combination. Since this relationship rests upon the records of only 6 children, the individual variation may have biased the results. The youngest child in the visual-manual group was successful on the easier problem, while the youngest child in the visual group was not.

ual guidance alone resulted
ndom exploration on the
s was still more marked
n was not allowed on the
ual guidance alone resulted
limited initial exploration
successful learners. Pos-
the preliminary exploration
visual. Visual guidance on
probably requires less pas-
e part of the child than the
nce the eyes may explore
and return to the moving
g guidance, while this is not
manual "putting through."
not explain, however, why
ned method was less effec-
the visual alone. Possibly,
ed method involved a divi-
attention between the two
ues, and the manual cues
stimulus to excessive activ-
erefore as a distraction from
m itself, rather than as an

ssible that visual guidance
remium in the set-up of this
was the case in some experi-
Richardson's (30) and in
(34) study with rats. In
the conclusion is simply that
s young as three years, can
tor task of a certain degree
ty when it is presented to
ally.

and 5), on the basis of his
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that the effect of vision
(1) a visual memory of the
prevention of tactual-kines-
ors in the learning process.
y, in which visual guidance
anual proved more effective
than a combination, throws weight toward the visual memory hypothesis.

Carr (4) was also of the opinion that individuals develop a visual idea of a maze pattern through non-visual guidance—an opinion opposed by the work of Brown, Husband, and Cutsforth. Our results indicate that if any visual idea was developed by these children through the manual guidance alone, it was an entirely erroneous one.

Other studies of method (35) showed that of the three methods of learning, verbal, visual imagery, and kinesthesis, the verbal was most effective, visual next, and the kinesthetic least. It was generally assumed that the learning of young children was mainly kinesthetic. Results of this study indicate that by three-and-a-half to four years at least, vision plays an extremely important rôle. It seems likely that any shift in receptor dominance from the kinesthetic to the visual modes has occurred by this age, and not as late as puberty—as some have advocated. The later shift is more likely toward increased dependence upon verbalization in ideational activity.

Whether verbalization played a part in the learning could not be ascertained. Some of the children could count as high as 10, but their actual concepts of number were not above four or five objects. Even granting their ability to count the turns, it is doubtful if this method occurred to them. Pyles' (25) study showed that naming of objects was an aid to learning but there the learning consisted in identifying an object of geometrical design, not repeating a movement. Johnson (17) found that children four to five years of age remembered two to three movements in the Knox Cube test after one demonstration. Repeated demonstration, in this study, resulted in memory of the successive movements in a longer series.

These results show that the lack of improvement in the ability of young children to reproduce a pattern, found by Hicks and Ralph (12) in a study of practice in tracing the Porteus Maze, and by Rice (29) after eye and hand training on the diamond, was probably due to the small amount of practice given in these studies. In this study, children three years of age improved measurably in ability to reproduce a complicated figure after 100 visually guided trials, even where learning was not complete. Rice's finding that success in reproduction was correlated with perceptual level rather than motor ability is confirmed and further defined by this study. Her work implies that perceptual level is dependent upon age and cannot be improved by training. This study indicates that it can be improved if the training is continued long enough.

With reference to the problem as stated in the beginning (p. 315) it has been demonstrated that stimuli initiated by the visual processes alone can produce appropriate motor responses in children as young as three years. Whether children younger than this must rely on kinesthetic stimuli from the responding organ itself for skillful motor activity is yet to be shown.

Further research on this problem should be directed, first, toward verifying the findings here presented with a larger group of children.

The disadvantage of this particular apparatus is in the difficulty in recording errors. A set-up which permits automatic recording of the child's performance should be devised.

This experiment has shown that visual cues were indispensable for learning in this particular situation. Other studies have indicated that it is less necessary in other situations. Analysis of the factors which are responsible for this difference should be attempted. There are indications in this study that cues from the manual guidance may result in elimination of excess distance after long training, and the correct number of turns may be achieved, but all this cannot be integrated into a particular pattern without visual aid.

Determination of receptor dominance should be pushed even further back into infancy by devising situations in which infant learning may be analyzed. Older children should also be studied with a view to establishing the hypothesis indicated by this study, namely, that the ability to use kinesthetic cues as the sole guidance in learning a series of coördinated movements that form a definite spatial pattern probably develops with age, instead of retrogressing. Further study should be made as to the part verbalization plays in the above process.

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Age Changes in the Physical Resemblance of Siblings[1]

CARROLL E. PALMER

NUMEROUS investigators, notably Galton (6), Pearson (11, 12), Pearson and Lee (13), Thorndike (14), Fisher (5), and many others, have studied various aspects of problems connected with the resemblances of offspring of the same parents. So far as can be ascertained, it is assumed in the studies thus far made that fraternal resemblance is static during the whole of life or, if such an assumption is not made, that it is sufficient to determine an average degree of resemblance which may be considered representative of all ages. From certain points of view, especially those relating to problems of inheritance, it may be immaterial whether or not fraternal resemblance remains precisely constant during the entire life span. In problems dealing with human growth, however, it would appear that a study of the change with age in the resemblance of children of the same parents might be of value in the analysis of certain sources of variation observed in growth processes.

An example of the kind of problem to which, inferentially at least, a study of the growth resemblances of siblings might be expected to contribute, arises in connection with the analysis of the marked increase in the variability of physical characters which occur in both boys and girls near the time of sexual maturation. One of the principal characteristics of this part of the growth cycle, as is well known, is a sudden acceleration, followed by a deceleration, in growth processes. Concomitantly with this acceleration and deceleration there occurs a great increase, followed by a decrease, in the *variation* of measurements of growth. While comparatively little is known of the factors responsible for the sudden changes in growth rates, the increase and subsequent decrease in the variability of measurements are attributed, (2) generally, to *variation in chronological age* at which the acceleration begins and ends in different individuals. At the present time, factors which may account for the differences in age at which the acceleration and deceleration take place are not clearly understood. On the basis of previous work on the physical resemblance of siblings it may be supposed that certain critical points in the progress of growth, for example, the age at which the acceleration begins, occur at more nearly the same age in brothers (or sisters) than in unrelated children. If a similarity of growth patterns in siblings is observed, and can be quantitatively evaluated, it would be possible to determine what portion of the increased variability in growth measurement of children in general is due to variation between siblings and what portion is due to variation between individuals not so related. Fisher (4) gives a discussion of this problem. A somewhat indirect but logical approach to this problem would appear to be feasible through an analysis of the correlation of measurements of brothers (and sisters) as they pass through the same successive critical ages. If this correlation of measurements remains relatively constant throughout the adolescent period, it may be that the time of acceleration and deceleration in growth occurs at approximately the same age in siblings of the same sex. On the other hand, if a change in the correlation of measurements is found, the extent of this change will furnish not only further detail of the nature of fraternal resemblance but will furnish, as well, some data for the quantitative determination of a further source of variability in growth processes.

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[1] From the Department of Biostatistics, The Johns Hopkins University (Paper No. 200) and the Office of Child Hygiene, U. S. Public Health Service.

Other questions of interest to the student of human growth arise as a result of a consideration of the resemblance of siblings. Thus, such pertinent questions may be asked: Are there sex differences in age changes of fraternal resemblances? Does order of birth influence fraternal resemblance? Are siblings widely separated in actual age more or less similar than siblings of nearly the same age? What effect does age of parents at the birth of their children have upon sibling resemblance?

An exhaustive study of even these relatively simple problems would require the amassing of a great deal of data not easy to collect. Entirely satisfactory material probably can be obtained only by taking long-time serial measurements of a great many siblings. So far as the writer is aware, no such body of data is available at the present time. However, in the course of an extensive investigation of the growth of children, undertaken by the Office of Child Hygiene of the U. S. Public Health Service at Hagerstown, Md., during the years 1921–28, material has accumulated from which it is possible to make a preliminary analysis of certain problems dealing with sibling resemblance.

This material includes, among other things, measurements of height and weight, recorded at least for 4 successive years, of approximately 2500 white children who attended the elementary grade schools of Hagerstown during 1921–1928. All of these measurements were made by trained field personnel of the U. S. Public Health Service and nearly 90 per cent were made by the same person. Height was measured in the erect standing position, without shoes, to the nearest $\frac{1}{4}$ inch, according to the technique prescribed by Hrdlička (7). The same measuring board was used throughout the whole period of observation. Weight was measured on carefully calibrated beam scales to the nearest $\frac{1}{4}$ pound and included the regular indoor clothing except shoes, coats, sweaters and vests. All measurements of weight used in this study were recorded in May in the successive school years and, although not precisely on the same day in May each year, the interval between weighings is considered sufficiently exact for the purposes of this study. Measurements of height were made in the spring months and where the interval was not exactly one year, arithmetic interpolations were made. For the classification of age, all children were grouped in single years of life as of the birthday nearest January 1 of the school year in which they were measured. For further information concerning details of the general investigation the reader may consult references (8, 9, and 10).

In the course of this 7-year investigation the height and weight of 193 pairs[2] of brothers and 154 pairs[2] of sisters were measured one or more times *when the two brothers (or two sisters) were of the same chronological age.* Thus 80 brothers were weighed when both were 7 years of age, 117 brothers were weighed when both were 8 years of age, the height of 63 brothers was measured when both were 7 years old, the height of 104 brothers was measured when both were 8 years old, and so on.

From these data it was possible to make correlation tables, specific for each age from seven to twelve years, of the height and of the weight of pairs of brothers and pairs of sisters. Thus the weight of older brother was correlated with weight of younger brother, when both were 7 years old, the weight of the older brother was correlated with the weight of the younger brother when both were 8 years, and so on. The original data on which the study is based did not include notations of birth order. The analysis is limited, therefore, to correlations of older and younger siblings, regardless of order of birth. Also, no account could be taken of the actual difference in age of the siblings but, because the period of observation extended only over 7 years, the greatest difference in actual age does not exceed 7 years. On the average the difference in ages of the paired brothers (and sisters) equals approximately 3 years.

The results of the analysis of the separate correlation tables are summarized in table 1. This table shows, specific for the 2 sexes, specific for each age from seven to twelve years, and specific for heights and for weights, the mean and standard deviation of the measurement of the older sibling, the mean and standard deviation of the measurement of the younger sibling, and the observed and "corrected" correlation coefficients, the Pearsonian r, for the measurement on the two siblings. Individuals placed in a single age class are not precisely of the same age, i.e., those grouped in the 7-year class included those between 6½ and 7½ years of age. Thus, of a pair of brothers entered in one table, one might have been just more than 6½ years of age and the other just under 7½ years. The effect of such grouping would tend, clearly, to give coefficients less than those which would have been obtained had all brothers been exactly of the same age. A simple method of correcting for this difference has been proposed, (see Boas (2) and Berkson (1)) and was used in the determination of the "corrected" coefficients.

In table 1 are given also the means, standard deviations and number of cases for measurements of height and weight of a large group of boys and girls who were measured in Hagerstown during the period of investigation

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[2] None of these pairs was twins. In a few cases there were 3 siblings in the same family, but in only 10 instances were there measurements on all three siblings at the same age. In each of these 10 cases, the three possible pairs of measurements were used but no account was taken of the fact that they were not independent. It was assumed, however, that no significant error would be introduced by treating these observations as independent.

TABLE 1

Constants derived from correlation tables of heights, and weights of brothers, and sisters; constants derived from frequency distributions of heights, and weights of all boys, and all girls. Elementary school children, Hagerstown, Maryland, measured during 1921–28

AGE	NUMBER OF PAIRS OF SIBS	MEAN		STANDARD DEVIATION		CORRELATION COEFFICIENT		MEAN	STANDARD DEVIATION	NUMBER OF CASES
		Older sibs	Younger sibs	Older sibs	Younger sibs	Observed	Corrected			
		Brothers (weight in pounds)						All boys (weight in pounds)		
7	80	48.87	49.15	6.25	5.57	.48	.50	50.63	6.44	596
8	117	53.97	54.46	6.46	6.12	.44	.46	55.07	7.38	839
9	168	58.84	59.36	6.90	6.65	.38	.40	61.57	8.71	987
10	149	64.35	64.58	8.05	8.03	.38	.40	67.22	10.53	992
11	103	71.08	72.15	10.16	10.03	.36	.38	73.91	12.36	868
12	63	78.11	78.06	12.15	11.02	.38	.40	80.98	15.01	681
		Sisters (weight in pounds)						All girls (weight in pounds)		
7	63	48.03	46.56	6.60	5.28	.32	.33	49.11	6.25	573
8	107	53.39	51.97	7.34	5.79	.33	.34	54.18	7.51	811
9	127	58.86	57.15	8.84	7.55	.25	.26	59.50	9.25	921
10	129	64.48	64.26	9.70	9.76	.24	.25	66.07	11.50	925
11	82	71.44	72.00	12.17	13.29	.25	.27	74.10	14.29	798
12	37	78.57	82.49	16.55	14.43	−.02	−.02	84.12	16.22	614
		Brothers (height in inches)						All boys (height in inches)		
7	66	46.00	46.17	2.20	1.89	.58	.63	46.27	2.15	710
8	104	48.02	48.39	2.29	1.81	.42	.46	48.48	2.19	851
9	129	50.48	50.15	2.28	1.95	.54	.59	50.63	2.28	977
10	154	52.18	52.12	2.18	2.13	.40	.43	52.47	2.38	1034
11	106	53.97	53.85	2.52	2.22	.37	.39	54.32	2.52	898
12	65	55.86	55.49	2.62	2.41	.55	.58	56.15	2.64	734
		Sisters (height in inches)						All girls (height in inches)		
7	64	45.70	45.45	2.18	2.65	.52	.56	45.80	2.10	679
8	79	48.22	47.73	2.12	2.39	.43	.47	48.02	2.17	797
9	118	49.96	50.01	2.34	2.49	.39	.41	50.06	2.30	909
10	123	51.96	51.84	2.23	2.34	.27	.28	52.13	2.39	960
11	93	53.97	54.03	2.60	2.65	.24	.26	54.23	2.70	859
12	37	56.03	56.03	2.98	2.77	.18	.18	56.62	2.99	654

(1921–28). These data furnish standards with which the measurements of the siblings will be compared.

RESULTS

Correlation of siblings. Figure 1 shows graphically the variation with age of the corrected coefficients of correlation. A considerable amount of irregular fluctuation in the coefficients is apparent. It may be noted, however, that the coefficients tend to be higher for brothers than for sisters, and that those for height are higher than those for weight. For brothers the average of the coefficients of correlation for all ages for both height and weight together equals +0.47 while a similar average for sisters equals +0.30. The average coefficient, all ages, of height for both brothers and sisters together is +0.44 and that for weight is +0.33.

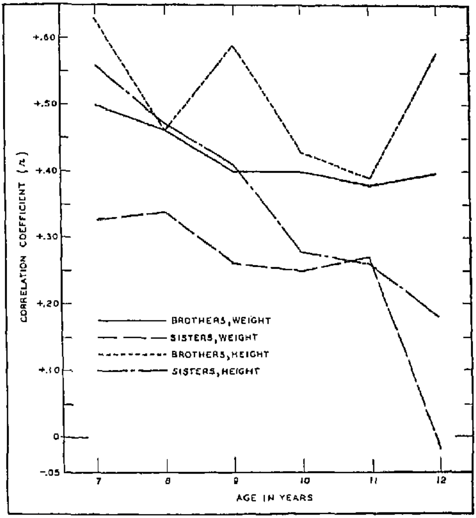

FIG. 1. CORRELATION COEFFICIENTS, SPECIFIC FOR AGE, OF THE HEIGHTS AND OF THE WEIGHTS OF SIBLINGS

The standard deviations of random sampling of the individual coefficients vary from 0.05 to 0.17. With these large sampling errors it is not possible, unfortunately, to evaluate with precision the age trends of the correlations for height, and weight, for brothers and sisters separately. Nevertheless, one fact can be noted, namely, *that the degree of correlation tends to decrease with advancing age during this period of growth.* The averages of the coefficients of height, and weight, for brothers, and for sisters, for the successive age classes are as follows:

7 years + .51
8 years + .43
9 years + .42
10 years + .34
11 years + .33
12 years + .29

The age change in this series of coefficients, while not great, indicates without much doubt that the resemblance of siblings of the same sex tends to become less with increasing age. According to these data the downward trend is fairly uniform during the whole period. Although the ages under observation do not extend far into the period of adolescent accelerated growth, there is no conclusive indication that the beginning of the accelerated phase, approximately 10 years in girls and 11 years in boys, is associated with a marked decrease in sibling resemblance. Taking all of the evidence at hand, however, it is fairly conclusive that the average correlations of these physical measurements of siblings at 12 years of age is probably not much greater than that implied by a correlation coefficient of +0.30. Pearson and other investigators have shown, and their findings are generally accepted as correct, that the physical resemblance of adult siblings is represented approximately by a coefficient of +0.50. If it can be assumed that the coefficient of +0.30 at 12 years is approximately correct it is clear that during the adolescent period siblings resemble each other considerably less than they have at an earlier age, say 7, and also, considerably less than they will at a later age, say in early adult life.

Another view of the change with age in general physical resemblance of siblings can be obtained through an analysis of variation. Suppose a large number of pairs of children of the same age and sex be drawn at random from the general population and an average measure of the differences between the pairs be expressed in terms of the average root mean square difference between their measurements. If σ denotes the standard deviation of the measured character, σ_u the average root mean square difference between 2 children, and r the correlation of the measurements of the two children, then the following well known formula may be written

$$\sigma_u = \sqrt{\sigma^2 + \sigma^2 - 2\sigma^2 r}$$

In case two unrelated children are drawn at random, r equals zero and the equation becomes

$$\sigma_u = \sqrt{2}\,\sigma$$

In case pairs of siblings are drawn at random from the population, assuming that the standard deviation of siblings is equal to the standard deviation of children in general, σ_{us}, the average root mean square deviation of siblings is

$$\sigma_{us} = \sqrt{2}\,\sigma\sqrt{1 - r}$$

The variability of two siblings drawn at random compared with the variability of two unrelated children can now be expressed in relative terms as the ratio

$$\frac{\text{Variability of siblings}}{\text{Variability of unrelated children}}$$

i.e.,

$$\frac{\sigma_{us}}{\sigma_u} = \frac{\sqrt{2}\,\sigma\sqrt{1 - r}}{\sqrt{2}\,\sigma}$$

or,

$$\frac{\sigma_{us}}{\sigma_u} = \sqrt{1 - r}$$

When r is set equal to +0.5, the estimated average value of fraternal cor-

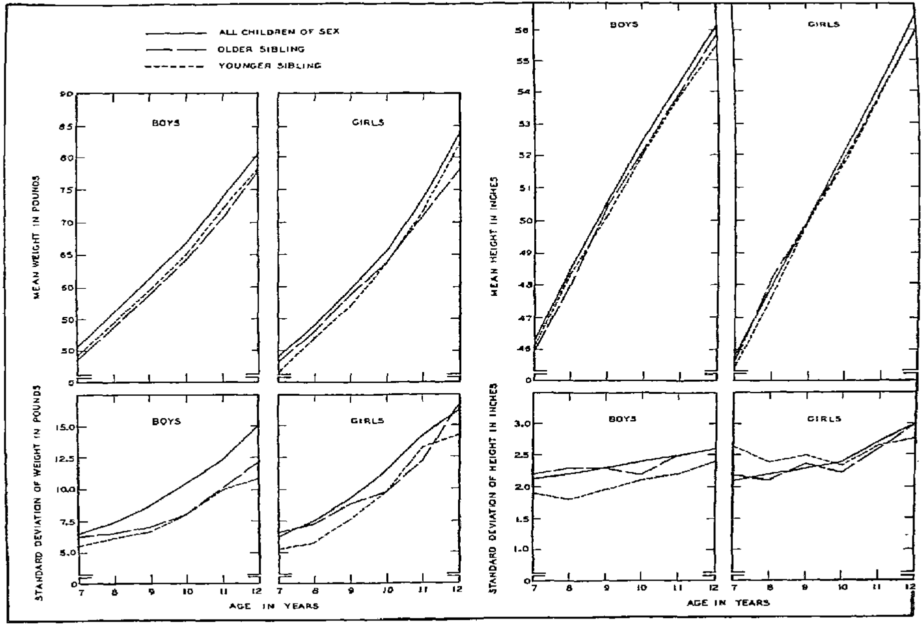

FIG. 2. MEANS AND STANDARD DEVIATIONS OF HEIGHT AND WEIGHT OF SIBLINGS COMPARED WITH THE MEANS AND STANDARD DEVIATIONS OF ALL CHILDREN

Elementary school children, Hagerstown, Maryland, measured during 1921–1928 relation at 7 years (and also adult life), $\frac{\sigma_{u_s}}{\sigma_u}$ becomes approximately .7 or 70 per cent. From this viewpoint, then, two siblings; drawn at random from the population of 7 year olds (or young adults) will show 70 per cent as much variation as two unrelated individuals drawn from the same population. When r is set equal to 0.3, the estimated value of the fraternal correlation at 12 years of age, the relative variability of siblings compared with unrelated individuals is

$$\frac{\sigma_{u_s}}{\sigma_u} = \sqrt{1 - .3} = .84 \text{ or } 84\%$$

Thus at 12 years of age the variability of siblings is 84 per cent as great as the variability of unrelated children. According to this somewhat arbitrary and obviously general view of the problem, at 7 years of age and again in adult life, siblings are 30 per cent less variable than unrelated individuals, while at 12 years of age siblings are only 16 per cent less variable than unrelated individuals.

With some caution, two conclusions may be drawn. First, at the age of 12 years brothers (and sisters) are more dissimilar in respect to height and weight than they were at 7 years of age and, also, that at 12 years they are more unlike, with respect to the same measurements, than they will be as adults. In other words, the growth patterns of brothers (and of sisters) are not identically similar on the scale of chronological age. The second conclusion, and this follows as a corollary from the first, is that at least a part of the variability of measurements of growth observed in studies of large groups of children is due to the differences in the growth patterns of hereditarily similar individuals, e.g., brothers and sisters.

As has been noted above, it would be of considerable importance to make a precise quantitative estimate of the portion of the variation of measurements of growth that may be accounted for from the two sources, first the variation arising as the result of differences of growth of siblings, and second, variation arising as a result of differences in growth of individuals not of similar heredity. Unfortunately, in view of the fact that the constants derived are subject to such large sampling errors, it seems wise to reserve such a quantitative analysis until more extensive and precise data are available. In this connection, it may be stated that further data are being collected which, when completed and analyzed, may be expected to furnish more conclusive and comprehensive results.

Height and weight of siblings compared with those of all children. In figure 2 the means and standard deviations of measurements of siblings are compared graphically with similar constants for all of the children measured in the Hagerstown investigation. With respect to weight, the averages at each age and the standard deviations at most ages are less for the siblings than for the total group of children. On the whole, the differences between the siblings and other children are larger and less irregular for boys than for girls but in general it is apparent, in this group of children, that boys who have brothers and girls who have sisters are both lighter and less variable in weight than the general population of boys and girls. With respect to height, the averages for the brothers are slightly but consistently less than those for the other boys; the averages for the sisters are more irregular but there is some evidence that girls with sisters in the group measured tend to be shorter than those without sisters. The standard deviations of the heights of the siblings fluctuate with some irregularity about those for other children and it must be concluded that variability of heights of siblings is not significantly different from the variability of heights of children in general.

A possible explanation of the difference between boys and girls in the general population and boys who have brothers and girls who have sisters may be due to the combined operation of differential fertility rates and growth rates of children from different economic levels. It has been shown by a number of investigators that children from the poorer economic classes are on the average lighter in weight and shorter in height than children from families in the better economic classes. It has been shown also that families of the poor tend to be larger than families of the more well-to-do. Although no quantitative evaluation of the operation of these factors can be given it seems not improbable that the observed difference of the siblings may be due to the differential selection of a large proportion of siblings from the lower economic groups.

SUMMARY

This study, based on measurements of height and weight of siblings at successive ages, shows that the coefficients of correlation of height and of weight of brothers and of sisters decrease with increasing age from the 7th to the 12th years. In the light of previous work on adult siblings, together with the result presented here, it is concluded that fraternal resemblance of physical characters is less at 12 years of age than it was earlier in life, say age 7, and less than it will be later, say, in early adult life. Study of the heights and of weights of siblings shows that boys that have brothers and girls that have sisters tend to be lighter in weight and slightly shorter in height, on the average, than a large group of boys and girls in the general population. The siblings measured tend also to be less variable in weight than the general group of boys and girls.

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A Comparison of the Abbreviated and the Complete Stanford Revision of the Binet-Simon Scale

LENOIR H. BURNSIDE

A CHILD of fifteen years seven months of age was given the Stanford Revision of the Binet-Simon Scale. Different methods of calculating the mental rating gave the following results: mental age—15 years 3 months, 16 years 8 months, or 17 years 2 months; intelligence quotient—98, 107, 109, 110, 119, or 123. If these diverse ratings had been secured by the use of different tests the difficulty of interpretation might be met by following the oft-made suggestion of labeling the result, *e.g.*, Kuhlmann mental age or Otis S. A. intelligence quotient. This is not the case: the above ratings were all obtained from one examination using the Stanford Revision of the Binet-Simon Scale. It is obvious that in the use of this scale more detailed labeling is advisable. These diverse ratings were obtained for mental age by using (a) the abbreviated form of the scale (starred tests on the blanks furnished by the Houghton-Mifflin Co.), (b) the complete scale, (c) the complete scale with the Terman correction (6) for the upper years of the test. Each of these mental ages yields an intelligence quotient with any chronological age used as the adult level of mental maturity. In this example chronological age levels of fourteen and sixteen years were employed as they are the more common in clinical practice. We have here then two sets of ratings determined by the use of the abbreviated or the complete scale of the Stanford Revision of the Binet-Simon tests. This observation of an actual case raised a number of questions in regard to the use of the two scales for clinical purposes.

Is there a significant difference in intelligence rating of individuals on the complete and on the abbreviated scales? If so, what per cent of individuals are affected? What constitutes a significant difference? Does this difference have a constant direction: (a) rated higher by the abbreviated scale; (b) rated lower by the abbreviated scale? What factors predicate this difference: (a) Chronological age, (b) mental age, or (c) intelligence quotient? Are the two scales equal in value for clinical purposes? If the results obtained by the two scales are so nearly identical as to be interchangeable, then for practical reasons the shorter of the two scales is the more desirable. It would materially lessen the time necessary for an examination and thereby make possible an increase in the number of subjects seen. This economy of time is of no small moment in school or court clinics where examinations are made under the heavy pressure of hundreds of cases.

This need for a reduction in time required for the giving of the complete Stanford Scale has prompted several investigators to devise abbreviated scales. Doll (2) made a selection of tests from the complete scale which "should exaggerate mental retardation in mentally defective subjects but would leave the mental level of normal subjects unaffected." For this scale he chose two tests per year from years V to X inclusive. The selection of the tests was based upon data from the examinations of 88 normal subjects, chronological age five to ten years, and 189 feeble-minded, mental age five to ten years with average chronological age 20 years. He states that "mental ranks will have practically the same reliability for the normal subjects as for the feeble-minded subjects, but the mental age values for the feeble-minded subjects will be from 5 to 10 per cent lower by the brief scale." Correlating mental ages on the two scales he obtained a correlation of .98 for the normal subjects, and .90 for the feeble-minded. Subsequently he selected "on the basis of experience" two tests per year for years III, IV, XI, and XII. This scale he suggests for use in the first five grades of the public schools.

Just after the war several other investigators reported experiments in devising brief scales made up of selections of test items from the complete Stanford-Binet Scale. These scales were developed to meet special conditions of psychological examining in the army. Lincoln, and Cowdery (4) reported on a scale made up of two tests per year. In this study there were 486 soldiers. The author points out that the order of difficulty of the tests for soldiers differs from that for school children. The conclusions from the studies of the briefer army scales have no value in our present investigation, not alone because of differences in subjects but also in scales under consideration. The complete army scale was itself an abbreviated scale made up of only four tests per year, not the same as the four starred tests of the Stanford-Revision blank.

Aside from the reports already mentioned of brief Stanford-Binet scales the only other found was that by Brooks (1). He used for a brief scale the four starred tests of the Stanford-Revision blank. The data given are of 575 individuals, chronological age range six to seventeen years inclusive. Although not specifically stated by the author it may be assumed from chronological age range that the subjects were school children. Brooks reports that the group as a whole was below normal. The differences in intelligence quotients on the two scales range from −33 to +31 points. The middle fifty per cent of differences is from four to seven points. After analyzing his data he concluded that the "abbreviated Stanford-Binet gives intelligence quotients from two to four points less accurate than those of the complete scale" and that "the abbreviated scale is almost as accurate as the complete scale, whether it be used to determine an individual's intelligence quotient or the relative mental standings of a group."

The data used in the present report

consist of the individual examination records of 375 pupils in the public schools of Rochester, N. Y. These pupils were those referred to the psychologist for aid in educational and vocational guidance, for the correction of some behavior or personality difficulty, or merely because parents wished to take the opportunity offered for psychological counsel, or because the pupils themselves requested it. Each pupil was given the complete form of the Stanford Revision of the Binet-Simon Scale. These complete test records were then re-estimated as if only the starred tests of the scale had been used. Throughout this paper the tests starred on the Stanford Revision of the Binet-Simon test blanks furnished by the Houghton-Mifflin Company form the abbreviated scale of the report. In calculating the intelligence quotient for the upper ages the sixteen year level for adult intelligence was used. The two sets of values thus obtained were then compared. Terman's correction (6) for the upper ranges of the test could not be used as data, for proportionate values to be added in using the abbreviated scale could not be obtained. The use of this correction would in some cases result in even greater differences than are here reported.

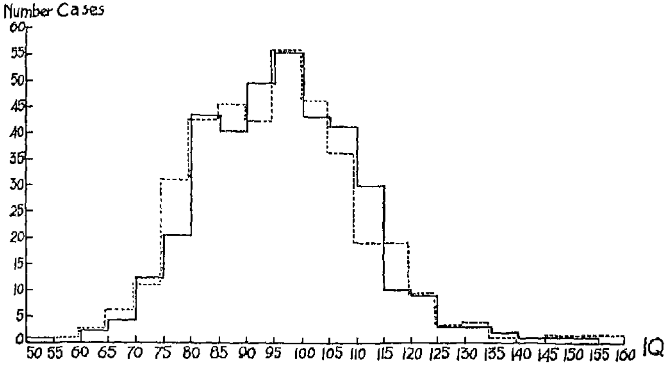

Fig. 1. Distribution of Intelligence Quotients —Complete Scale
--- Abbreviated Scale

The chronological age range of the group was 11 years 2 months to 20 years 8 months inclusive. The mental age range on the complete scale was 8 years 6 months to 19 years 0 months; on the abbreviated scale 8 years 9 months to 19 years 6 months. The range of intelligence quotients on the complete scale was 53 to 154; on the abbreviated scale 55 to 156. Rated by either scale approximately fifty per cent of the group fall within the limits of normality as defined by Terman (5). The distribution shown in figure 1 follows rather closely the normal curve whichever of the two scales is used.

TABLE 1

Differences in intelligence quotients, abbreviated minus complete scale rating. Three hundred and seventy-five cases

DIFFERENCES IN IQ	FREQUENCY	TOTAL FREQUENCIES IN EACH GROUP	PER CENT OF TOTAL NUMBER OF CASES
−14	1	66	17.60
−13			
−12	2		
−11	3		
−10	2		
−9	3		
−8	7		
−7	11		
−6	17		
−5	20		
−4	17	273	72.80
−3	25		
−2	25		
−1	35		
0	36		
+1	40		
+2	38		
+3	30		
+4	27		
+5	9	36	9.60
+6	12		
+7	7		
+8	3		
+9	2		
+10	2		
+11	1		
+12			
+13			
+14			

Table 1 shows the distribution of the differences in intelligence quotients when the intelligence quotients obtained on the complete scale are subtracted from the intelligence quotients obtained on the abbreviated scale. It is seen that 273 cases or about 73 per cent show a difference of less than five points. This amount of variation may be assumed to be insignificant unless consistently in the same direction. Therefore, in the large majority of cases the two scales give quantitative results approximately equal. This finding is in agreement with Brook's (1) statement that the abbreviated scale is almost as accurate as the complete scale to determine the relative mental standings of a group. This quantitative similarity may, however, conceal qualitative differences of great significance for individual diagnosis. The equivalence in mental age rating cannot be construed as diagnostic equivalence. Subject S. B. is illustrative of cases where the quantitative difference is insignificant but where the qualitative differences are significant for the clinical psychologist. This girl's chronological age was 16 years 4 months. She failed test 3, one of the unstarred tests, in year XII. Performance on this test was too poor even for credit at the eight year level. Because of this failure it was necessary to go back as far as year VI for a basal year. If only the abbreviated scale had been used year IX would have been the basal year. The total quantitative difference of 2 points in intelligence quotient was not significant, but the knowledge of the subject's failure on test 1 in year VIII and tests 2 and 6 in year VII, these latter two starred tests, would be worthy of consideration in a clinical diagnosis for educational guidance. The intelligence rating itself does not furnish sufficient means for mental diagnosis.

A difference of five or more points in

intelligence quotient is assumed to be a significant difference. This amount is an arbitrary one chosen because it covers half the range of any of the Terman classification groups except that of the normal. From table 1 it is seen that 102 cases or 27 per cent vary to this amount. The range of this variation is from −14 to +11 points in intelligence quotient. Quantitative differences among this 27 per cent appear sufficiently great to be of importance in any study of an individual. The range of variation reported in this investigation is not as great as that reported by Brooks (1). In the process of analyzing his data Brooks seems to have overlooked the individual in his effort to discover the general agreement between the two scales under consideration.

It may be interesting to give here several cases having what the author considers a significant absolute difference in rating. Interesting diagnostic differences will be noted also. Case number 1, R. F. boy, chronological age 14 years 5 months. Using the complete scale the basal year is VII, but using the abbreviated scale the basal year is X. In this case not only is the quantitative difference of 8 points in intelligence quotient large enough, perhaps, to be considered significant, but also for an analysis of the subject's possibilities and limitations it is valuable to know that he fails in test 1 year VIII, test 6 year IX, test 3 year X, test 3 year XII, and that he succeeds in test 2 year XII and test 2 year XVI.

Case number 2, A. G. girl, chronological age 16 years 9 months. In the upper years of the test it is fairly common practice, in cases where good rapport between the psychologist and the subject has been established, to begin the examination with the vocabulary test, and to proceed from the year level indicated by the rating obtained on this test. If this were done in the case of A. G. using only the abbreviated scale the mental age rating would be 11 years 0 months, intelligence quotient 69; but using the complete scale successes on both unstarred tests in year XIV, all other tests of this year having been failed, leads one to continue. The successes in year XVI and year XVIII are starred tests. Her achievement in school and her social adjustment indicate that the rating obtained by use of the complete scale more accurately represents her intellectual level.

Case number 3. Likewise in the case of M. N., chronological age 13 years 8 months, mental age obtained by use of the abbreviated scale only would have been 11 years 5 months with an intelligence quotient of 84. This would be 11 points lower in intelligence quotient than that obtained by the complete scale. In using the abbreviated scale all starred tests in year XIV were failed, yet there were successes on starred tests in years XVI and XVIII. These would not have been discovered in using only the abbreviated scale, for the examination would have stopped at year XIV.

Case number 4. On the abbreviated scale the intelligence quotient for C. W. was 14 points lower than on the complete scale. Beyond the XII year group of tests there were six successes, five of which were not included in the abbreviated form. An analysis of these successes in a clinical diagnosis may be of more value even than the very large variation in intelligence quotient would suggest.

Does the difference between the two forms of the scale have a constant direction so that it may be corrected by conversion constants? Table 1 shows 168 cases rated lower by the abbreviated scale, 66 of these, or 39 per cent are five or more units lower; 171 cases are rated higher by the abbreviated scale with 36 of these, or 21 per cent, five or more points higher. It is thus seen that the difference in intelligence quotient between the two scales does not tend in any constant direction for the group under consideration; so cannot be corrected by conversion constants.

What is the relation of this difference to chronological age? The correlation coefficient of difference in intelligence quotient with chronological age is found to be −.08 P. E. ±.03, This is practically zero correlation and indicates that the younger and the older children are equally affected by the change of scales.

What is the relation of difference in intelligence quotient on the two scales to mental age on the complete scale? The coefficient of correlation here is −.10 P. E. ±.03. Thus it is seen that the subjects below and those above average in mental age rating are affected about equally, for no significant correlation exists between the two.

The correlation coefficient for differences of intelligence quotient on the two scales and the intelligence quotient on the complete scale is −.07 P.E. ±.03. Here again the correlation is insignificant. This indicates that for this group the brighter and the duller children are about equally affected.

Correlations between the two test series were not computed. It has been pointed out (3) that correlations obtained whenever the measurements obtained from one set of data are included in those of the other set are spurious correlations. Since the brief scale is exactly two-thirds of the complete scale a very high correlation between the two would be inevitable. But it would be a spurious correlation. Such are many of the correlations of .90 and above reported in previous studies of the abbreviated scales of the Stanford Revision of the Binet-Simon Scale.

In treating statistically the data from the two sets of measurements one learns that for about three-fourths of the cases the briefer form gives results similar to the complete form. But for the other fourth the variation is significantly great. Which of the two scales is the more valid has not been determined. However, in a statistical treatment of data one is apt to overlook the individual in the process. A study and diagnosis of individual differences is the primary object of clinical psychology. It is generally agreed that the greater the variety of standard situations the less likelihood of invalidation due to environment or to educational opportunity. For this reason the complete scale is to be preferred to the abbreviated scale for subjects presenting exceptional or puzzling problems. Terman writes: "The brief form is by no means as reliable as the entire scale. It should be used only when it is absolutely impossible to make a complete test." In a letter to the author of this paper he states also that data on which he bases this conclusion or on which the starred tests were selected have not been published.

SUMMARY

This paper is a report of differences in mental rating obtained by using the complete Stanford Binet Scale and the abbreviated Stanford Binet Scale, starred tests on the Houghton-Mifflin Company blanks of the Stanford Revision. The data are from 375 examinations of public school children whose chronological age range is 11 years 2 months to 20 years 8 months inclusive. The purpose is to emphasize some of the differences significant for individual psychology. The group on which the data are computed shows a normal distribution in intelligence ratings as determined by the Stanford Revision Scale.

A difference of five points is arbitrarily chosen as a significant difference in intelligence quotient because it covers one-half the range of any of the Terman classification groups except that of the *normal*.

A significant difference in intelligence quotient is found in 27 per cent of cases when ratings obtained by the complete and abbreviated scales are compared.

There is no constant direction of difference in intelligence quotient between the two scales for the group under consideration. Therefore, no correction constant may be used.

The correlation between chronological age and intelligence quotient differences shows the younger and the older children equally affected by the change of scales. Subjects above and subjects below average in mental rating are equally affected by the change in scales. The brighter and duller children as judged by intelligence quotient ratings on the complete scale seem to be about equally affected by use of the abbreviated scale.

The variation in intelligence quotient between the two scales is insignificant for about three-fourths of the group. *Variation for the other fourth is large* enough to be considered significant.

Qualitative differences may be great enough to be worthy of note for clinical diagnosis even when quantitative differences are small.

In conclusion, the more extended form of the scale is to be preferred to the abbreviated form for use in making a clinical diagnosis of an individual.

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A Study of Attention in Young Children[1]

MARY FRANCES BESTOR

ALTHOUGH studies of the attention of young children have been few in number, a technique of observation has been developed. This involves diary and time records of the behavior of young children in certain somewhat controlled manipulations similar to, if not identical with play. In general, these studies have defined attention span as synonymous with activity span, and have not distinguished between activities to which attention is actually directed and those which merely continue if uninhibited.

Mueller and Pilzecker in 1900, according to Foster (4), pointed out that ideas possess a perseverative tendency which generally passes rapidly away, but which, when attention is directed intensely upon the idea, strongly persists. There is considerable difference of opinion as to the significance of this factor. Foster's (4) study revealed no facts in support of the assumption that such a tendency to perseveration exists. Lankes (5), on the other hand, found that there is a distinction between perseveration through the nervous system, and persistence through actual effort and individual will power.

Cushing (2) made a study of the tendency in preschool children, defining it as a particular drive of the organism toward continuous activity of an organic pattern once aroused. She found a common factor throughout the occupations of young children involving manipulative materials of a simple repetitive sort, which may be accounted for by perseveration. The writer herself points out that it is impossible to be sure to what extent the perseverative tendency is coterminous with "interest in manipulation," a common factor in activity situations of this nature.

In order to limit the scope of the present investigation, attention has been defined in as limited and as specific a fashion as possible. Dashiell (3) has defined it as the attitude facilitating the response of an individual to some particular stimulus or stimuli. This definition which restricts the range and nature of stimulation and rules out the tendency to perseveration, has served as a guide to the interpretation of the term throughout the investigation.

In order to differentiate between attention and interest in activity it seemed advisable to select materials that would be meaningless. Just as nonsense syllables have been devised to test learning, so it was thought that nonsense visual and auditory stimuli could be devised to test attention. To render a visual stimulus meaningless it is necessary to get away from color and pattern. For a meaningless auditory stimulus it is necessary to eliminate melodic and rhythmic pattern. Because it is so difficult to isolate tactual, olfactory and gustatory stimuli, they have not been included in the present investigation. The ommission of tactual stimuli was made with a definite purpose in view, namely to eliminate manipulation in order to minimize as much as possible the tendency to perseveration.

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THE EXPERIMENTAL SITUATIONS

The experiment involved three distinct series of situations, an original experiment and the repetition of two previously published experiments. The test devised to meet the requirements for a meaningless visual stimulus presented a colorless light shining behind an irregular, opaque field about two square feet in area. The light flashed off and on, at short and irregular intervals. It was placed behind a screen so that it could be observed only from a limited area of approximately 12 square feet. While the child was within this area he was considered to be reacting to the stimulus, but he was free to move about the room as much as he wished. There was nothing else in the room during the experiment. With half of the subjects the visual situation was presented twice. The general outline of the field of light differed in the two situations, but both were, to all intents and purposes, meaningless.

The problem of finding meaningless auditory stimuli was more difficult, but a solution was presented by the Victrola records of the Seashore test for pitch discrimination, in which there is scarcely any rhythmic pattern and the changes in pitch follow no melodic pattern. Each Victrola record took three and a half minutes to play and there was no explanatory comment to offer distraction. Short of actually constructing records, there was no more suitable material available. The Victrola was started before the child entered the room, and was placed out of sight in a closet. In only a few cases was it necessary to play more than one side of the disc, and with the exception of these cases the child did not see the instrument at all. The door into the hall was left open to permit freer movement in and out of the range of the auditory stimulus. There was nothing in the room, and the duration of the attention span was recorded as the time spent in the room.

A study by Shacter was selected for repetition because it purported to be a test of attention, although, in the writer's opinion, the behaviour measured was not limited to attention but included interest in manipulation and perseveration, as well.

Shacter (6) defined attention span simply as the time during which a given activity continues without external compulsion or persuasion. In trying to eliminate situations in which a goal was implicit, she chose materials which would lend themselves to repetition in manipulation tending to indefinite perpetuation. She found no appreciable difference in the length of the attention span at the three levels, but found an increased span in proportion to the complexity of the activity.

In a second study, Shacter (17) attempted to find out whether or not there was a relationship between intelligence and attention span, as was suggested by the dependence of the length of the period upon the complexity of the activity. A rating was obtained through a composite scale made up of the verbal tests from the Stanford-Binet series, a performance test from the Merrill-Palmer series, and a picture pointing test from the Detroit Kindergarten series. Her hypothesis was not supported by the results, which indicated that some other factor than mental ability is operative. The principal criticism which can be made of such studies of the attention of young children is concerned with the basic assumption that attention span is synonymous with duration of activity.

The two situations selected were chosen because they seemed most suitable to the age group which was to be observed, not because of any preference expressed by the original experimenter. In addition to the time records, a detailed account of the type of manipulation, color and form discrimination, and the comments, both relevant and irrelevant made by the subjects, was recorded at the time of observation.

To provide a measure of the perseverative tendency, the auditory and the visual experiments of Cushing's study were repeated. The two situations selected, namely the visual and the auditory, were chosen as those most nearly corresponding to the type of situation to be presented in the third part of the experiment. Diary records as well as time records were kept during this series also. The two tests were presented on the same day, the auditory invariably preceded the visual.

The third series consisted of the visual and auditory situations described at the beginning of this section. In the Cushing and Shacter experiments the child's performance was preceded by demonstration. The present experiment required no demonstration since no manual response on the part of the child was necessary. No directions were given except immediately preceding the experiment. In the visual situation the child was told that there was something he might see if he looked behind the screen. As soon as the child passed the screen and came within the area where the light was visible the stop watch was started and was not stopped until he left that area. No further remarks were made by the experimenter except in answer to individual questions. In the case of the auditory stimulus, before the child entered the room he was told there was something which he might hear. A record was kept of the time spent in the room itself. In a few cases it was necessary to say to the child that he might leave the room when he was through looking or listening. A record was kept of all such instances together with the circumstances preceding and the child's reaction.

Each child was observed in each of the 3 series, and in every case, but 1 series was presented on a single day.

Teacher's Rating Scales

To provide a means for evaluating the traits which were being measured by the original experiment, a rating scale was devised by which each child was rated by three Nursery School teachers. The following statements were graded as to their applicability to the behavior of each specific child, on the basis of a five-point scale:

1. *He attends to one thing for a long time.*
2. *His attention is attracted easily.*
3. *His attention is distracted with difficulty.*
4. *He always finishes an activity begun.*
5. *If interrupted, he returns to the original activity.*

If the description of behavior were exceptionally true of the individual's behavior he was rated 5, if exceptionally untrue 1; merely average manifestation of the behavior was graded 3. Thus there was a possible range of from 5 to 25 points per child per observer. Since Conrad (1) found that no matter how significant the factor of skewness might be in individual judge's ratings, the significance practically disappeared if three or more judges' ratings were averaged, the final score for each child was the average of the three teachers' ratings.

The Subjects. The subjects for this investigation were drawn from two sources. In each group there were 7 four year olds, 8 three year olds and 3 two year olds. The first group, which will be designated as Group I, consisted of eighteen children from the Mills College Nursery School between the ages of twenty-nine and fifty-eight months. In Group I age was not a selective factor. The group as a whole had had several months together, were familiar with the part of the building in which the investigation room was located, and were in daily contact with the experimenter in the regular routine of the Nursery School. The selective nature of the enrollment provided that, as far as family background was concerned, this was a fairly homogeneous group, if not a widely representative one.

Group II, on the other hand, was drawn from an Emergency Nursery School which was held in the Mills College Nursery School building in the afternoons. The 18 children were selected as most nearly approximating the ages of the corresponding children in Group I. The age range was from twenty-nine to fifty-five months. Group II forms a heterogeneous group as to the economic and educational background of the families represented. The requirement for admission to the Emergency Nursery School was an income as low as that required by the county for relief, but the vocational training of the fathers ranged from day laborers up to the professional class. The majority of the fathers were unemployed except for part time. Some of the parents had had as little as six years of elementary school, while others had had as much as five years of college education. None of the children, with the exception of brothers and sisters and cousins, had been together before the beginning of the investigation period, or had had other school experience. They were unfamiliar with the entire second floor of the Nursery School building where the investigation room was located, except for those who had been brought to the doctor's office for physical examination. The experimenter came into contact with the child only in the observation situation. Added to these dissimilarities in conditions, the second group was less likely to be familiar with much of the material used in the first part of the tests, than were those who had had considerable nursery school experience. It is for these reasons that the data for the two groups is, in some instances, analysed separately. In general, the observation period for each child in Group I covered from two to four weeks; in Group II the period ranged from four days to two weeks.

Reliability of the Original Experiment. Since two of the three series had been previously used, no effort was made to estimate the reliability or validity of these. In the case of the original experiment, however, various methods were employed to determine its reliability as a measure of attention. The visual part of the series was repeated twice with the children from Group I.

Comparison of the results by the Pearson product moment method yielded a correlation of .36 ±.13. This correlation is not only too low to indicate any significant reliability between the first and the second presentations of the visual stimulus, but, in addition, the probable error is so large as to make it impossible to place any confidence in the measurement.

The teachers' ratings were used as a further check on the reliability of the two series. A fairly high correlation, +.70 ±.08, was found between the teachers' ratings in Group I and the score for the auditory series. In Group II, however, the correlation approaches zero: +.07 ±.007. There may be many factors which account for this marked discrepancy, the most important of which is the difference in the experience of the raters. In Group I the ratings were made by experienced nursery school teachers who were familiar with the method and had had considerably more opportunity to observe the children whom they rated, both over a longer period of time and in a larger number of situations, than the teachers in Group II. Although the same ratings are correlated with the scores obtained from the visual stimulus, the same discrepancy does not appear. In Group I the correlation is +.30 ±.14 and in Group II +.29 to ±.14. Neither of the correlations obtained between the visual score and the teachers' ratings can be viewed with confidence because the probable error is too large in both cases. These scores give the first indication of a tendency which other aspects of the analysis emphasize in various ways, namely that the trait or process of attention is not identical in the two sets of situations. The common use of verbal directions in the nursery school may perhaps provide the teachers with a better opportunity to judge auditory than visual attention, and it may be that the ordinary judgment of attention is largely based upon this type of attention in place of any other.

When results from the entire group of subjects in the 2 series are correlated, a coefficient of only +.28 ±.10 is obtained. When the results from Group I only are used, the correlation is slightly higher, +.39 ±.13, and in this case, the probable error is relatively smaller and the coefficient may be regarded with more confidence as a measure of relationship. It is interesting to note that when a partial correlation is made between the scores of

Group I on the visual and auditory tests with the factor of the teachers' ratings held constant, the self correlation drops from +.39 ±.11 to +.19 ±.10, a significant drop of .2 points in correlation, but without a similar drop in the probable error.

These results, then, indicate two main trends, namely that auditory and visual attention are not identical but are probably distinct and specific traits or abilities; and secondly, that judgments of children's attention tend to be more accurate with respect to auditory than to visual attention, contrary to common supposition. Neither statement has received sufficient support in the data so far cited, but one is justified in concluding that such trends are at least indicated.

Differences between Visual and Auditory Attention. The difference, already referred to, between the scores obtained on the visual and on the auditory situations in the original experiment, have been studied from a variety of angles. In the first place, very low negative correlations are obtained when either set of scores is correlated with chronological age. The correlation between the auditory situation and age is −.13 ±.10 and the correlation between the visual situation and age is −.20 ±.11. The relationship between the scores on the visual and the auditory series has already been shown to be represented by the coefficient +.28 ±.10. If the formula for partial correlation is used and age is kept constant, the correlation between the two series is hardly altered at all, since there is only a drop from +.28 ±.10 to +.26 ±.11. In other words, the lack of correlation between the two tests is apparently not due to age differences.

The influence of the factor of training in terms of the length of time the individual child had been in the nursery school was studied. Group II was omitted in this correlation because the entire group had entered simultaneously, and from this point of view, presented a homogeneous group. The children in Group I represented a range of from two to twenty-two months in the Nursery School, with an average length of attendance of a little over 7 months. A somewhat significant difference in the correlations between the length of time in the nursery school and the two situations appears, for the correlation between the auditory situation and the length of time in the nursery school is +.11 ±.16 and the correlation between the visual situation and the length of time in the nursery school is −.14 ±.16. The size of the probable error in both cases makes it impossible to place a great deal of confidence in either correlation. However, it is interesting to see that a similar difference between the two aspects of attention persists. For Group I the correlation between these two aspects is +.39 ±.13. By means of partial correlation, when the length of time in the nursery school is kept constant, the correlation becomes +.41 ±.09. Because there is scarcely any change in the correlation between auditory and visual attention as measured in this experiment when the length of time in the nursery school is held constant, there is indication that whatever the difference between the two may be, it is not affected by those factors which are altered through school experience and training.

Another measure of the factor of training can be obtained by means of the standard error of the difference between the scores made by Group I and Group II on the two series. For the auditory scores the obtained difference is 108 and the sigma difference is ±32.9. There is practical certainty that the true difference will be greater than zero. As far as the visual series is concerned, the obtained difference is 66, the sigma of the difference is ±48.8, and the chances are 99 out of a hundred that the true difference will be greater than zero. There is a difference, then, between the scores obtained for the two groups, but not one which accounts for an additional difference between auditory and visual attention.

Data with respect to the intelligence rating of individual children was only available for thirteen children in Group I. Owing to the fact that the tests were given over a considerable period of time, it was necessary to use intelligence quotient rather than mental age in comparison. The range represented quotients from 98 to 165 with an average of 118. Correlations between intelligence quotient and score on the two tests indicate differences similar to those shown by correlations involving length of time in the nursery school. The correlation between the auditory situation and intelligence is +.34 ±.16 and the correlation between the visual situation and intelligence is −.15 ±.18. Although both correlations are low and both probable errors are high, it is interesting to see that the negative coefficient appears once more in the case of the visual situation. When intelligence quotient is kept constant by means of partial correlation, the correlation between the auditory and visual situations is only raised from +.32 ±.17 to +.39 ±.09, indicating that differences in intelligence are not responsible for the differences between auditory and visual attention as measured by the experiment.

By means of the standard error of the difference the reliability of the obtained difference between the average scores for boys and girls on the 2 experiments can be determined. For the auditory series there is an obtained difference of 21 and a sigma of the difference of ±32.9. The chances that the true difference between boys and girls will be greater than zero are a little more than half, or 69 out of a hundred. For the visual series the obtained difference is 24 and the sigma difference ±49.8; the chances that the true difference will be greater than zero are the same as they are in the case of the auditory series. In other words the differences between the scores made by boys and girls are practically identical in both cases, and so the discrepancy between visual and auditory scores cannot be accounted for on the basis of sex differences.

Having eliminated chronological age, intelligence, school experience and sex differences as determining factors in the apparent differences in auditory and visual attention as measured by the present experiment, it remains to analyze individual differences. Methods for treating such data quantitatively are few. However, it is possible to correlate scores with certain types of overt behavior when they can be subdivided into two categories, by the use of the method for discrimination of bi-serial correlation,

$$r = \frac{M_2 - M_1}{\sigma} \cdot \frac{r9}{z}.$$

The type of behavior which seemed to reappear with most regularity was an interest in, and questions about, the mechanical origin of the stimulus. Such questions took various forms:

R. D. (58).[2] "What is it? I don't know what it is."

G. P. (54). "What's it supposed to be? Why doesn't it stay on a long time? Is it warm? Is that fire there?"

D. R. (51). "How does it turn on? What is it made out of? Is there a light in there? Does it go on all night?"

R. K. (47). "What's that? What makes it go on? Oh, there's a lady downstairs who makes it go on."

M. R. (36.) "Where'd you get this thing? Can it burn you? Can I get close to it?"

G. P. (54). "What is it? Is it a victrola? Is it in here? Can I see it?"

All of those who either asked questions or offered explanations of the mechanical origin of the stimulus were placed in one category, and those who did not were placed in the other. On the face of it, this may not appear to be representative of a normal distribution. Although the behavior falls easily into two categories, it spreads out as a normal distribution from a merely passing interest in the mechanics of the stimulus to considerable curiosity. The correlation between the asking of such questions and the total score in the visual situation was found to be only +.25 ±.10. In the auditory situation the correlation was +.49 ±.08. The second of the two correlations may indicate a tendency for the auditory score to depend upon interest in the mechanics of the stimulus. This is not a basis for assuming that the difference between auditory and visual attention lies in the dependance of the former upon mechanical interest. It is rather an indication that the nature of the auditory stimulus used in this investigation, in order to attract and hold attention, presupposed an interest in what made it go.

What is of much more value than statistical treatment of individual differences is a qualitative analysis of the individual differences in behavior. Although in many cases the same type of behavior was displayed in both situations, the reactions of T. W. (40) provide an interesting contrast. In the visual situation in which his score is the largest, he walked confidently up to the light, stopped suddenly the first time it went on, and then nodded his head slowly up and down. At first he stood very straight with his hands on his hips, but soon he began to slump and his feet and hands became restless. He began to sigh and to breathe heavily and to stretch his back and shoulders. Finally after fourteen minutes he took something from his pocket and directed his attention to it and so he was told that he might go. In this case he quite evidently had imposed upon himself the strain of paying attention for an indefinite length of time, and was not capable of bringing the period to an end without outside intervention. On the second trial his general reaction pattern was similar except that after three and a half minutes he said that he wanted to leave. During the auditory situation none of the *strain* or fatigue was present and he apparently had no hesitation about telling the experimenter that he was through and wanted to go. The antithesis of this behavior is to be found in the record of P. K. (29). She entered the room during the auditory experiment, asked a few questions, looked out the window, and then started to go out the door when she suddenly stopped and said: "Oh, hear. What's that?" then moved about the room some more, so noisily that the sound could not be heard, and then left the room. Her reaction was both late and very short-lived. A great many of the children apparently expected something to play with and would ask for it. F. V. (35) always asked for the material of the immediately preceding test, no matter in what series he was, at the moment, being observed. There was considerable divergence in the adaptive behavior exhibited during the auditory situation. The majority of the children were not aware that the sound came from the closet, at least at first, and generally looked behind the screen where the light had been, in an effort to locate it. M. R. (36) was the only one who thought that the noise came from outside the room, and actually went out into the hall to find it, asking questions all the time. T. R.'s (26) exploratory behavior with respect to the visual stimulus was unique. He blinked his eyes and turned his head back and forth apparently duplicating the intermittence of the sensation. He tapped on the floor and on the wall and table, looking quickly around to see the light after each tap, evidently seeking some connection between the flashing light and his own movements. B. A. M. (49) was the only child who noticed a thin crack between the screen and the wall through which it was possible to catch a glimpse of the light as it flashed on and off. She tried to run around the screen from the light to the crack before the light went off. This was, of course, impossible but she persisted in her attempt for some time. On the second trial with the visual stimulus she repeated this behavior, but paid no attention to the same screen during the auditory experiment.

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[2] The numbers in parenthesis indicate the child's age in months.

The evidence presented by these examples of overt behavior, comments, and questions leads but to one conclusion, namely that individual differences are of more importance in an estimate of the qualities of attention, than any group variations due to age or sex or intelligence or training. How much these variations are due to individual habits of behavior and how much they depend upon the situation of the moment remains to be seen. Additional information with respect to individual differences may serve to indicate trends, even though they cannot present any positive proof.

Perseveration. The attempt has been made, in planning the two situations of the original experiment, to eliminate as far as possible the tendency to perseveration. The results from the original experiment have been compared with those from the study of perseveration made by Cushing. Correlations between the perseveration scores and age, in addition to bearing out Cushing's own findings, show a difference in favor of the younger children similar to that found in the original experiment. When the auditory and visual scores are correlated with one another, the resulting correlation is +.72 ±.05. This is an extremely significant one, both because it is high and can be viewed with confidence, and because it is in marked contrast to a similar relationship for the original experiment, namely +.28 ±.10. In other words, the evidence points to the fact that though auditory and visual attention as measured by the experiment, are two distinct and dissimilar factors, auditory and visual perseveration are similar if not identical.

Further investigation of these relationships was made by correlating the visual situations in both experiments with each other, and the auditory situations with each other. The correlation between the visual situations is found to be +.40 ±.09 when all 36 cases are used and +.47 ±.07 when only group I is used. Both correlations are higher than the corresponding ones of +.33 ±.10 and +.30 ±.07 for the auditory situations. The relationships tend to remain much the same when the factor of age is held constant by means of a partial correlation. For the entire distribution, when age is partialled out, the correlation between the auditory situations becomes +.32 ±.10, and for the visual situations +.35 ±.10. When length of time in the Nursery School is kept constant for Group I the relationships are scarcely altered at all. For the auditory situations the correlation becomes +.28 ±.14 and for the visual, +.49 ±.12. In neither case is the change of any significance except in so far as the direction of the change may indicate that length of time in the nursery school is of more importance with respect to visual attention and perseveration than in the case of auditory.

The Original Experiment Compared with the Shacter Attention Test. The two situations from Shacter's attention test have been assumed to be typical of most of the tests of attention devised for use with young children. The scores present considerably less variation than is presented by either set of scores from the original experiment. The coefficient of variability of the Shacter attention test is 24.8 while for the original auditory series it is 84.9 and for the original visual series it is 134.7. However, the present investigation tends to indicate that individual differences are of considerably more importance than any group factors. If this assumption is true then a test which produces a rather homogeneous set of scores for attention is apparently not a fine enough measure.

The overt behavior and questions which were recorded for individual children during the test, were analyzed and show that there was no relationship between the total score and the relevancy of the comment made or the question asked. There was found to be slightly more of a relationship between the total score and the ability to discriminate form than between the total score and the ability to discriminate color.

The chief significance of these results lies in the fact that they add further evidence that scores on an attention test, in terms of time spent, are not descriptive of the attentive process at all, and that a study of the qualitative differences reveals much more with respect to the nature of that process as it actually is.

A Comparison of the Behavior of

Twins. The present investigation was fortunate in having among the subjects in Group I a pair of fraternal twins, 47 months old, whose behavior affords interesting contrasts in individual differences. There was considerable divergence in the opinions of the judges with respect to their attentive behavior but when the ratings were averaged M.'s (the girl's) score was 18.3 and B.'s was 17.3 while the average for the group was only 14.9. Time, both for the visual and for the auditory situations of the original experiment was closely related, but their behavior was entirely different. M. came behind the screen, turned around almost immediately and walked out, and then walked back in again, saying "Nice. See light?" She looked away frequently and then back at the light again each time, saying: "See, it goes. See, can't see. Pitty. Very nice." B. in the same situation, sat down on the floor near the light, then got up on his knees. He squirmed around a great deal and went in and out several times, looking constantly to the experimenter apparently for comment, and showing considerable interest in the writing of the record. On the second trial the behavior closely resembled the first in both cases, although the time spent was doubled in the case of B., and reduced to about a third in the case of M. In the auditory situation M. tiptoed about the room, and apparently located the sound as coming from the closet for she stood there a long time before going back to her chair to sit down. B. moved about a great deal, too, but with no apparent purpose, and no apparent interest in the sound. All three of these records serve to emphasize the fact that a time record of attention is not only an inadequate but frequently an inaccurate measure of the attention.

A wide difference in total time score is to be found in the case of the test for perseveration. As might be expected from the behavior described above, B.'s score is much larger than M.'s, five times greater to be exact. B. spent a very long time with the electric bell pushing it with his thumbs, his fingers, against the table top, and even on his knees and the toes of his shoes. M., on the other hand, merely rang the bell a few times and remarked that there was "noise in there (pointing to the closet). Pitty noise." They shifted their attention on the second trial with the auditory apparatus nearly the same number of times, M. a few less than the average for the group, and B. the same number of times more than the average. The fact that M. was especially apt at sound localization in both the original experiment and in the perseveration test may be due to superiority in sensory acuity over her twin. Such an advantage, in this case at least, is interesting in that it reduces the total time score on both tests, rather than increasing it as might be supposed. It would be extremely valuable if a high negative correlation could be found to exist between sensory acuity and perseveration. Since no information on that subject is available it is at least interesting to note an indication of it in the behavior of the twins. Though neither of the twins, when they entered the Nursery School, five months previously, was using normal speech, by the time the investigation was carried on, they had both made considerable progress. M., however, was the only one who spoke at all in either of these experiments.

With the third series of tests, the Shacter attention test, the twins were outstanding in that, with one exception, they spent the longest time of any of the children, their scores being almost twice as long as the next longest score in the group. They were among the few children who used up all the materials before stopping; most of the children stopped long before the box was empty. Both used the same technique in color discrimination. They removed a large handful of pegs from the box and then picked out of it all of one or two colors, laying them aside and dropping the rest in the box. Though an obvious procedure it was followed only in three or four other cases. Their method of discriminating form was not so strikingly original since they merely fitted pegs in beads before dropping them through the hole, as did a large number of the other children. B. made a single comment during the series. When looking for a certain peg, he said, "I want a green one." M., however, talked quite a bit, always about the materials.

These contrasts have demonstrated the range of possible individual difference in the behavior patterns involved in attention. They present as striking similarities as they do differences, but their chief value in this connection is the emphasis they place upon the need for a qualitative estimate of the attention of young children.

SUMMARY AND CONCLUSIONS

The following indications have been brought out by an analysis of the data obtained in this investigation:

1. There is a significant lack of relationship between the scores obtained on the visual and on the auditory situations of the original experiment. This lack of relationship between the two factors persists even when age, sex, intelligence and school experience are held constant by statistical measures.

2. There is a difference in all scores between the two groups observed, in favor of Group I. However, within Group I there is no evidence that score is affected by the length of time in the nursery school. Therefore, the conclusion is drawn that there are other factors of more importance which distinguish the two groups from one another, namely, familiarity with the experimenter and with the experimental room, amount of previous experience with the materials, and the length of time intervals between the tests.

3. There is apparently little relationship between such qualitative aspects of behavior as relevant and irrelevant conversation, form and color discrimination, and the total time score.

4. In the case of perseveration, low correlations between total score and the number of shifts of attention indicate that there is no relationship between a tendency to perseveration and a tendency to shift the attention.

5. Analysis of overt behavior and comments indicates that significant variations in behavior do not appear in a score for attention based merely upon the amount of time spent.

6. Individual differences in the group studied appear to be of a great deal more importance than any developmental factors, in determining the nature and duration of the individual's behavior while attending. The selec-

tive character of the sampling, both from the standpoint of the age range and of the number of subjects, makes it impossible to conclude that the above statement holds true for the field of attention as a whole. It does indicate, however, that developmental factors may be of less importance than is commonly supposed, and that behavior patterns exist irrespective of age, sex, intelligence or training.

The most important single conclusion which is indicated is that auditory and visual attention are not identical or even similar processes, and that the individual's capacity to attend to one type of stimulus is apparently in no way related to his capacity for attention to the other. The practical considerations which are involved, could this conclusion be shown to be true, are of the greatest importance. Attention in education has largely been thought of as a unified process. If, however, it differs with the different senses all material for learning should not be presented in the same way and adjustments to individual facility might bring about a greater increase in the ability to learn. The assumption that individual differences far outweigh such factors as age, intelligence and training, would indicate a need for the revision of the norms and standards in learning which are based upon age or training factors.

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Development of Motor Control in Young Children; Coordinated Movements of the Fingers[1]

MARGARET KARR

THIS study was undertaken to investigate the motor control and coördination of the hand and fingers of young children. A particular task which involves primarily the use of the fingers is set for the children; namely, the manipulation of scissors.

More specifically, this study concerns finger coördination with the purpose of finding:

(1) The relationship between the manipulation of scissors and chronological age
(2) The relationship between the ability to cut and mental age
(3) Additional information as a contribution to the question of handedness
(4) Sex, individual, and personality differences shown in the experiment.

Twenty-two nursery school children, 12 girls and 10 boys, ranging in age from twenty-four months to fifty-nine months, served as subjects. The mean chronological age was 42.5 months; the median chronological age was 43.2 months. Mental ages of the subjects, as tested by the California Pre-school Schedule I, ranged from 24 months to 71.5 months (with a mean age of 48.2 and a median age of 52.7 months).

A series of 22 papers, each containing one design was presented to the children in a definite order. The designs were drawn with black lines one-sixteenth of an inch wide on white medium weight mechanical drawing paper. Each line began on one edge of the paper, continued toward the center, and terminated with a small gold star. The series of designs ranged in complexity from a number of short vertical lines to a twisting line. One paper contained a 9-inch vertical line, another a 9-inch horizontal line, another a 12-inch diagonal line. Several papers had designs with vertical or horizontal combined with diagonal lines thus forming angles of varying degrees. Three more had each a curved line, a semicircle, and a complete circle. Five of these designs which began on the right side of the paper were mirror images, i.e., duplicate designs beginning on the left edge. The series was preceded by a plain practice sheet.

A simple frame was originated onto which each paper was thumb-tacked. The frame consisted of three strips of wood forming three sides of a 10-inch square, the fourth side being open in order that the subject might cut into the area. The frame was clamped parallel to the table top so that the cutting space extended between the table and the chair in which the subject was seated. The device held the paper steady, firm, and in a similar position for each person tested.

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[1] From the Department of Child Development, Mills College.

The scissors used in cutting were the steel-bladed and blunt-pointed kindergarten type, with evenly rounded metal loops for the fingers, and were easy to manipulate.

The children were tested on school days in the morning between nine and eleven o'clock. They were brought singly into the testing room. Before the cutting began, the subjects were given certain finger coördination items of the Merrill-Palmer Mental Test. Then the frame was clamped into place. The child's knees fitted under the extended part of the frame and his bent elbow was on a level with the table. Such a position was used consistently for each subject because it was the most comfortable arrangement obtainable and allowed freedom for arm and hand movements. The papers were presented in an arbitrarily set order. On the practice sheet, the subject was told to cut from the free edge into the paper anyway that he desired. As each paper of the series was presented, the child was instructed, "Cut *on* the black line, up *to* the star." The scissors were laid on the paper directly in front of the child, handles toward him so that he might pick them up with either or both hands.

The number of papers cut on one day varied with the age, attention and ability of the subject. On the average, four or five papers were presented at each testing period of twenty or thirty minutes. At such a rate, at least five days were needed to cut the series.

Several systems of scoring the cutting results were devised and checked one against the other. By examining the papers, false moves could be counted and recorded for each paper. *False moves* were defined as places where the scissors tore the paper rather than cut it; places where the child closed the scissors the full length of the blade and picked up the cut in the middle to go on; holes where the ends have hit the paper before the blade; sideway jags.

A second method of scoring graded the papers for accuracy. Each line was divided into three-inch segments. If the cut was on the line, four points were given for each division. If the cut deviated from the black line less than one-sixteenth of an inch it was graded three points. Two points were given for the segment if at any place the cut deviated from one-sixteenth of an inch to three-sixteenths of an inch. One point was allowed if the cut fell between three-sixteenths of an inch and one-half of an inch. No credit for cuts more than one-half of an inch away from the line, on either side. The perfect score for nine-inch lines was 12; twelve-inch lines, 16; fifteen-inch lines, 20.

A third method of scoring is a modification of the one just described. Four experienced nursery school teachers, A and B from one locality and C and D from another locality, cut the series of papers under the same specifications as the children. Then they rated the papers on a scale of difficulty in cutting from 1.0 to 5.9. The judges were instructed to keep in mind the motor skills of young children. By the Spearman rank difference method, ratings of

A and B correlated...... .95±.01
C and D correlated...... .89±.03

The averaged ratings of A and B correlated with the averaged ratings of C and D .92 ±.02. Because of the high correlations obtained, the average of all ratings was used as a basis of difficulty, and the papers were weighted accordingly.

DATA

Results of the scissor-manipulation experiment have been studied with reference to chronological age and mental age. Only 15 children were able to cut the entire series. Their records have been analyzed with respect to handedness, false moves, and time required. Further differences in the ability of the children in the performance of this task were also considered.

The weighted and unweighted scores of the children were correlated with chronological age. Two children who cut with one scissor loop in each hand were eliminated from the relationship on the ground that their ability did not show finger coördination. The following correlations were obtained from the remaining twenty subjects. Spearman rank difference:

C. A. and unweighted score.............. $r = .72 \pm .08$
C. A. and weighted score.............. $r = .71 \pm .08$

The relationship between the age of the child and his ability to manipulate scissors is probably due, in part, to the increased physiological capacity of older children.

Comparison of the ability to cut accurately with mental age gave higher and more significant correlations:

M. A. and unweighted score.............. $r = .85 \pm .04$
M. A. and weighted score.............. $r = .84 \pm .05$

The greater correlation with mental age than with chronological age indicates that the ability to manipulate the scissors is a mental as well as a physiological accomplishment. For example, the scissors must be held perpendicular to the paper, closed to a certain degree, guided along the line. Some of the designs made it necessary to hold the hand in awkward positions while cutting. The child's insight into these problems is also involved in the correlation of score and mental age.

The weighted scoring system was of value in emphasizing the spread of the distribution of the results. A graph of these scores displays a bimodal curve; one group could cut very little, the other group cut well enough to attempt to follow the line. This bimodality of the curve may be due to incomplete sampling of the group studied; but a definite attempt was made to obtain subjects to fill the gap. These, however, were found to cut either acceptably or practically not at all. The question may be raised whether this is evidence of a maturational factor, whether the ability to oppose thumb and fingers in a scissor cutting motion appears when the hand has developed sufficiently.

Fifteen subjects cut the entire series. In most cases, they were able to manipulate the scissors automatically and their attention could be focused on the line. They could hold the hand steady and direct the cutting, while the five children who made the lowest scores centered their attention on the scissors. The first group found difficulties in the mirror image lines. In these complicated situations, they, also, became absorbed in their finger coördination.

To determine whether speed and accuracy go together in this task, the following correlations were computed, using the Spearman rank difference method for the fifteen subjects who completed the cutting exercises:

Median time in seconds and unweighted score.............. $r = -.33 \pm .16$
Median time in seconds and weighted score.............. $r = -.31 \pm .16$

The correlations might have been higher if the time score had been more accurate. Since the children stopped frequently to talk during the cutting of a design, such individual differences made this measure only suggestive. The correlation between time scores and chronological age in this study was r = .26 ±.17. The time required to cut did show personality differences for the individual children. Some took a long time consistently for each paper but longer for the more difficult ones; others cut the series rapidly; a few were inconsistent. The experimenter's subjective judgment, substantiated by her acquaintance with the children, is that the time scores were characteristic of the child's general reaction.

The number of false moves of the fifteen children who completed the cutting series were ranked from the highest to the lowest. Spearman rank difference method yielded the following correlations:

False moves and C. A............... $r = -.30 \pm .16$
False moves and M. A.............. $r = -.59 \pm .12$
False moves and unweighted score .... $r = -.76 \pm .08$
False moves and weighted score .... $r = -.81 \pm .06$
False moves and median time.......... 0 *correlation*

The correlation between false moves and chronological age was lower than the false moves and mental age. Such a relationship suggests that children with higher mental ages:

1. Close the scissors to make only the necessary length cut rather than closing them the full length of the blade
2. Fit the scissors into the cut and proceed evenly
3. Direct the scissors sideways rather than "jag" the scissors sideways to get back to the line.

Subjects who made higher scores also made fewer false moves. Children who cut slowly did not consistently make fewer or more errors than children who cut rapidly.

All but one of the 15 subjects changed from one hand to the other, or used the left hand on lines that were drawn from left to right. It is true that the cutting papers as designed encouraged this alternation. The assumption was made that the child who cut with the right, then left, and then both hands on a difficult paper showed less consistent use of the right hand than the child who alternated right and left. Therefore, the subjects were ranked on a scale of diminishing use of one hand from right, right and left, right and left and both, to left. The rankings correlated as follows:

Consistent use of the right hand and C. A. . . . . $r = .77 \pm .08$
Consistent use of the right hand and M. A. . . . . $r = .55 \pm .13$

The findings support the theory that as a child grows older, he uses one hand more consistently. It is interesting to note that the correlation with mental age is the lower, although some of the mirror image papers would have been easier for the child to cut if he had changed to his left hand. The habit formed by learning and maturation probably is stronger in the child who is older chronologically.

Four items from the Merrill-Palmer tests which involve finger coördination were given all the subjects.

1. Folding paper
2. Closing fist and wiggling thumb
3. Cutting paper into strips
4. Opposing thumb and fingers

Eleven children passed the series. The median of their weighted score was 656. Three children passed 3 items. Their median weighted score was 518. Two children passed three items with their median weighted score 43. Of the four children who passed none of the tests, three received a score of zero, while one made an 8. The 2 children who were eliminated because they cut with both hands failed on the thumb and finger opposition test. Another child who failed this item made a cutting score of 550. The 2 children who made the lowest scores for the series failed on both of the finger coördination items.

The experimenter realized that some of the subjects have had more specific practice than others. A questionnaire was filled out by the writer during an interview with each child's mother. The purpose was to divide the children into the following classification:

Group A—cut very often at home
Group B—cut frequently at home
Group C—cut occasionally at home
Group D—never cut at home

From the groups who do cut at home, the girls use scissors more frequently than the boys. The median weighted scores show that the children who have had more home experience can cut more difficult papers better than those who have had less practice. One of the two children who cut with both hands fell in group C with a weighted score of 422. The other child fell in Group D with a weighted score of 14. The group who never cut at home was composed entirely of children under three years of age.

The children in the same six-month-age intervals were matched according to sex. Seven pairs were available. The median weighted score for the girls was 544 and for the boys 477, a difference of 67 points. This small advantage in favor of the girls is hardly significant. It may be accounted for by the difference in specific home practice or perhaps to an earlier maturation of girls.

The children were allowed to hold the scissors any way that they desired. Children with the higher chronological age were the children with the larger hands and they used one finger and thumb to manipulate the scissors. The median chronological age of this group was 54 months. The children with the smaller hands, median chronological age 43.5 months, fit two fingers into one loop. The youngest children had not learned the most efficient way of holding the scissors, or perhaps their hand muscles are not developed sufficiently to manipulate the scissors in an adult fashion.

Individual differences in the children's method of cutting appear in the experimenter's comments. Some have used extreme care, watching the line attentively. They were apt to cut more slowly and to make precise small snips. Others slashed one cut after another across the paper, closed the blade the full length at one stroke. They made fewer false moves, but a poorer accuracy score than the first group. Many of the children steadied the scissors by holding the upper blade with their free hand; usually the left hand did the guiding when the right hand was in an awkward or difficult position. There was a marked difference in the angle at which the scissors were held. The "best" cutters held the scissors so that the intersection was on the line, one blade above and one blade below, and the scissors perpendicular to the paper. Some children cut with their hand above the paper, blades pointed down. Others cut with their hand below the paper, blades pointed up. A more popular position, which increased the steadiness and accuracy, was to slide the upper blade along the line and close the lower blade up to meet it. Seven of the children, all boys, closed the scissors so forcefully that the paper tore, sometimes along the desired place. One child when cutting a difficult line, held his right hand in the air, opening and closing the fingers as he opened and closed the scissors with his left hand. The child displaying this bilateral drainage, was aged 44 months, group C in home practice, and ranked eleventh in accuracy of cutting by the weighted score.

Two of the children could open but could not close the scissors; several held the scissors parallel with the paper so that they made no cut. From this group, one boy aged thirty-one months, was given 6 practice periods, and one girl aged twenty-four months, was given 6 practice periods during the two months. They were instructed how to hold the scissors also how to open and close and fit them into a paper. At the end of the training, the children could make successive cuts holding the paper with the free hand.

The children's remarks show certain personality traits. Some gave up easily, saying "I can't," with each paper presented. Others made positive remarks such as, "I think I can cut this." "I'll try." Many of the children imagined the design to look like an object. Several of the older children recognized resemblances to letters. Some of the children repeated syllables or phrases over and over as they cut. Several criticized their own efforts. Two of the children talked incessantly about other matters. Many made remarks which were suggested by the papers or the immediate surroundings. All but the smallest children made comments about the lines, the stars, observing differences and similarities between the papers.

RESULTS

Results of this study are merely suggestive for they are based on a small number of cases. They relate to finger coördination in a specific task in which the child cuts along a line on paper held horizontally and firmly for him. An analysis of the data obtained leads to the following tentative conclusions:

1. The chronological age of the subjects determined to some degree the ability of the children to cut on the line.

2. The more intelligent children cut more accurately than the less intelligent ones of the same chronological age.

3. The graphic distribution of the subjects' cutting scores showed a bimodal curve, one group being capable of cutting sufficiently well to make an acceptable record on the test, and one group being unable to manipulate the scissors adequately.

4. There is no significant relationship between the median time required to cut the series and the accuracy of the cutting.

5. Speed in cutting did not increase with chronological age.

6. The children with higher mental ages and the children who followed the line more accurately, also made fewer false moves.

7. Consistency in the use of the right hand became greater as the child grew older in years. The correlation was not as great when consistency of the hand used was compared with mental age.

8. Subjects who passed four finger coördination items from the Merrill-Palmer mental test, made higher scores on the cutting papers than the children who failed one or more items.

9. The group of children who had had more home practice made a higher median cutting score than the children with less specific practice in using scissors.

10. Sex differences were slightly in favor of the girls.

11. Individual differences in methods of holding the scissors appeared to be dependent on the size and muscular development of the hand.

12. Methods of cutting showed individual and personality differences for each subject.

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